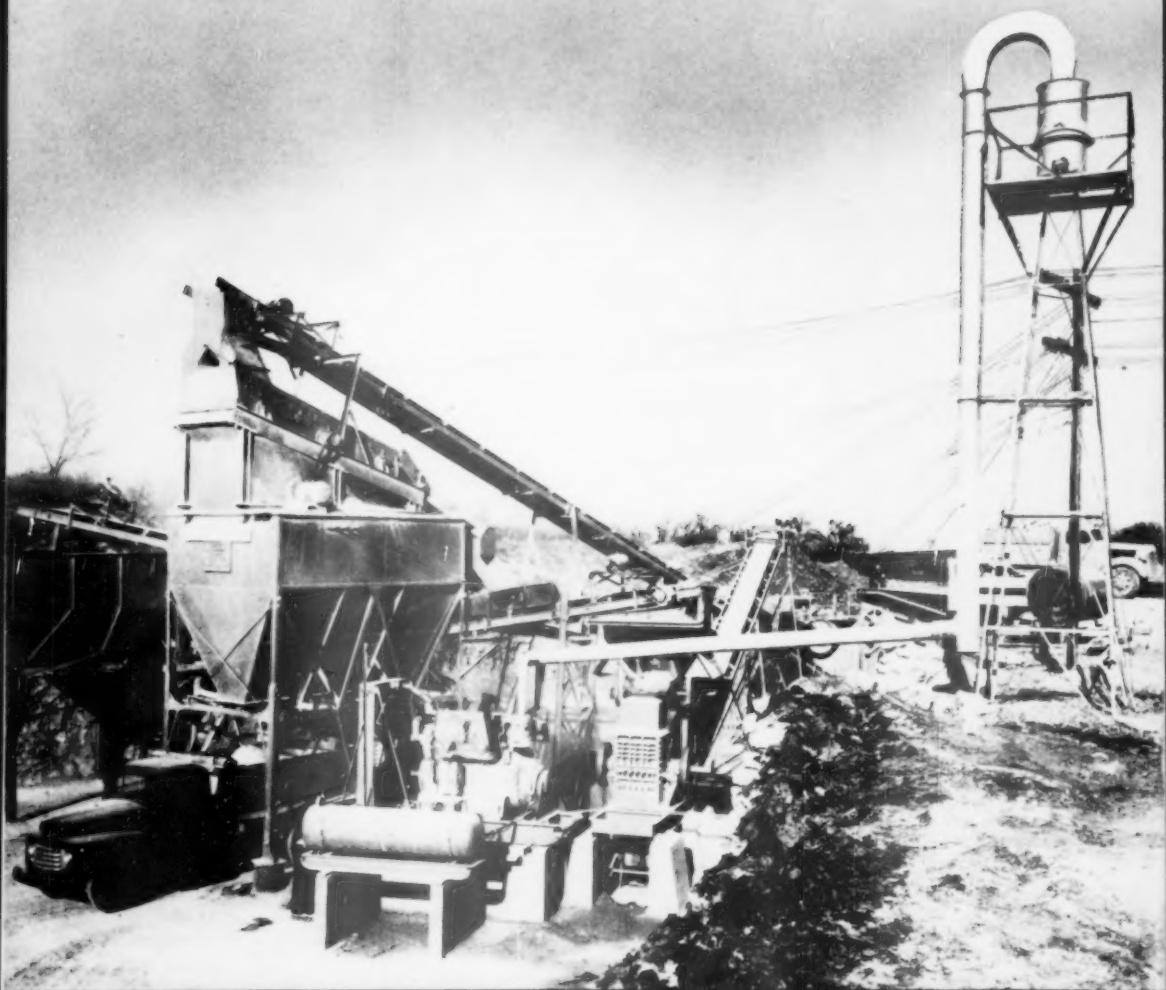


THE INDUSTRY'S RECOGNIZED AUTHORITY

ROCK PRODUCTS

LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD





...Cut Down

"TRUCK ABSENTEEISM"

put MACK TRUCKS on
your job



"Truck Absenteeism," like its human counterpart, disrupts the efficiency of your business . . . adds materially to your costs.

Actual job records prove that with Mack trucks on the job "truck absenteeism" is reduced to an absolute minimum. That's because Mack trucks have built-in durability . . . extra reserves of strength and stamina. Because they're better built, they're better able to stand up to the demands of hard-working, day-in, day-out service.

Work done on the job will always be the one true yardstick of truck value. Figured that way, every Mack truck gives full measure — and more — in round-the-clock dependability; longer, more trouble-free mileage life; sustained earning power; and rock-bottom maintenance costs.

On the job — and on the job records — it proves out every time: "YOU GET MORE WORK OUT OF MACK TRUCKS, BECAUSE MORE WORK GOES INTO MACK TRUCKS."

Be Profit-Wise
Modernize with



Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada, Mack Trucks of Canada, Ltd.

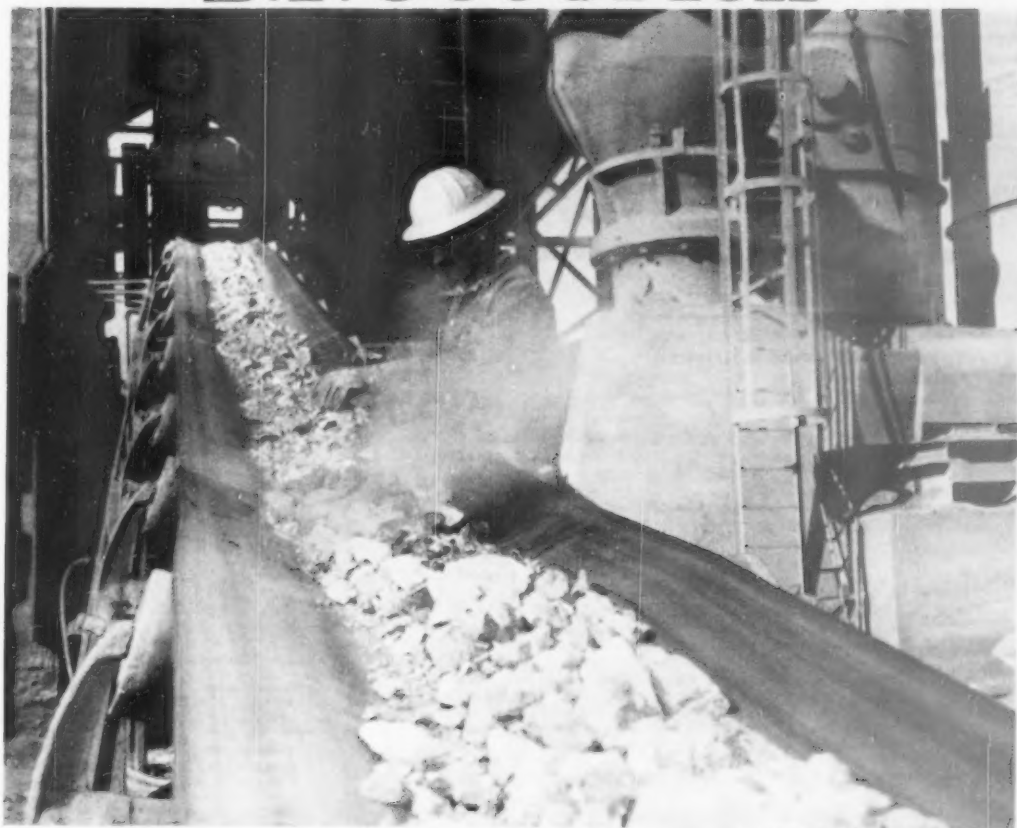


Photo courtesy Kaiser Aluminum & Chemical Corporation

Hot rocks ride on rubber

A typical example of B.F. Goodrich product improvement

HANDS OFF! Those are hot clinkers of chromite, an ore used in making bricks for furnaces. To get the ore ready to stand heat, they give it heat—up to 240° to dry it out. The clinkers—still so hot you could fry an egg on one—are dumped on the rubber belt that takes them to a storage bin.

The longest any belt had lived with these hot rocks was 90 days, usually only 60 days. Even during this short life, belts had to have "first aid" for burns, patches to keep burned spots from getting deeper and spreading. The ore has to keep moving—8 hours a day, 5 days a week. Not much time

for repairs, and a new belt every two months is an expensive way to carry hot clinkers.

The B.F. Goodrich man was called in. BFG had developed a special heat-resisting rubber for belts to handle hot rocks, coke, sand, and other materials that would sizzle right through ordinary rubber. A B.F. Goodrich hot material belt to stand temperatures up to 300° was installed. It lasted 9 months, 3 times longer than any previous belt. The belt shown here is in its tenth month, a ripe old age for belts in this kind of service.

Making a belt to stand terrific heat

is typical of improvements made in other B.F. Goodrich belts—belts to carry materials that tear and cut ordinary rubber, stand crashing blows of dropping coal and rock, carry oily foods and grains, move packages uphill and downhill. BFG research constantly improves them all. That's why you can get more service from industrial rubber products by calling in your local BFG distributor. *The B.F. Goodrich Company, Industrial and General Products Division, Akron, O.*

B.F. Goodrich
RUBBER FOR INDUSTRY



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3 Basic SIDE-DUMPS

DOORLESS PAN • LIFT DOOR • DROP DOOR

All three types are available in truck bodies and trailers, offering a choice in capacities suitable to meet every requirement in off-highway transportation of earth, rock and ore. EASTON truck bodies and trailers are used in service with all makes of commercial or off-highway trucks or truck tractors.



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LIFT DOOR. Extra large capacity EASTON lift door trailers and truck bodies are establishing remarkable performance records in mine and quarry service. Dumped by overhead hoist.



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Side-Dump Truck Body
Automatic Drop Door
Capacity, 16 tons

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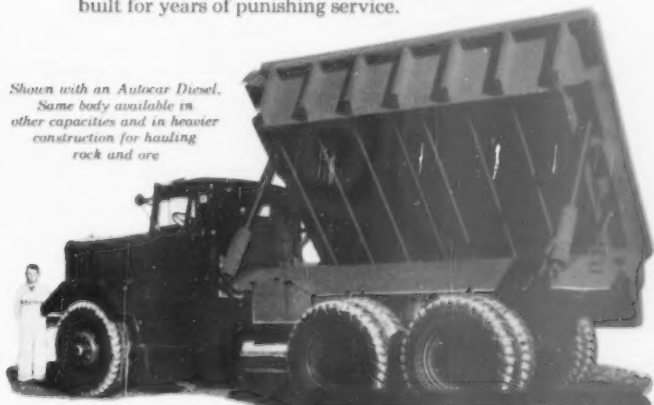
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extra payload The box-shaped body, especially designed for versatile earth moving service, packs maximum payload into minimum overall dimensions.

extra speed The body shape provides a big, easy target for fast shovel loading. Side dumping lets you roll up, dump and roll on with no time lost for backing and turning. The door operation is completely automatic—rugged and amazingly smooth.

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*Shown with an Autocar Diesel.
Same body available in
other capacities and in heavier
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rock and ore*



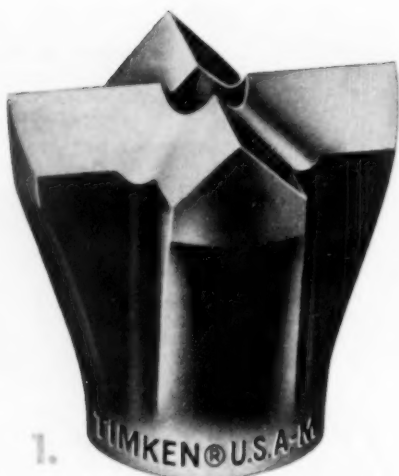
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Only TIMKEN® offers all 3 rock bit types

WHICHEVER type of removable rock bit is best for your drilling job, you can get it from Timken®. Only Timken makes *all three* rock bit types—multi-use, carbide insert, and one-use.



1.

1. **TIMKEN MULTI-USE ROCK BIT** gives lowest cost per foot of hole when full increments of steel can be drilled and when control and reconditioning are correct.

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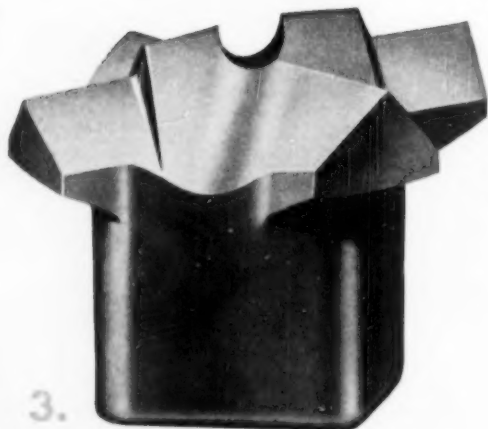


2.

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To help you select the *one* best bit for your job, Timken offers a *complete* Rock Bit Engineering Service. With *all three* types of rock bits to draw upon, the Rock Bit Engineering Service can help you get the bit performance your job needs—whether it's lowest bit cost, lowest cost per foot of hole, greatest possible drilling speed, or other desired advantages.

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3.

TIMKEN

**your best bet for the best bit
... for every job**

Easy Moving means faster handling



WHAT about the handling jobs around the mill? Unloading and setting machinery, handling fuel or bulk materials and the hundred and one odd lifting jobs that could cost less and be done more quickly with a Northwest Truck Crane. The Northwest Truck Crane is a better machine for the heavy work of mining and mill operations.

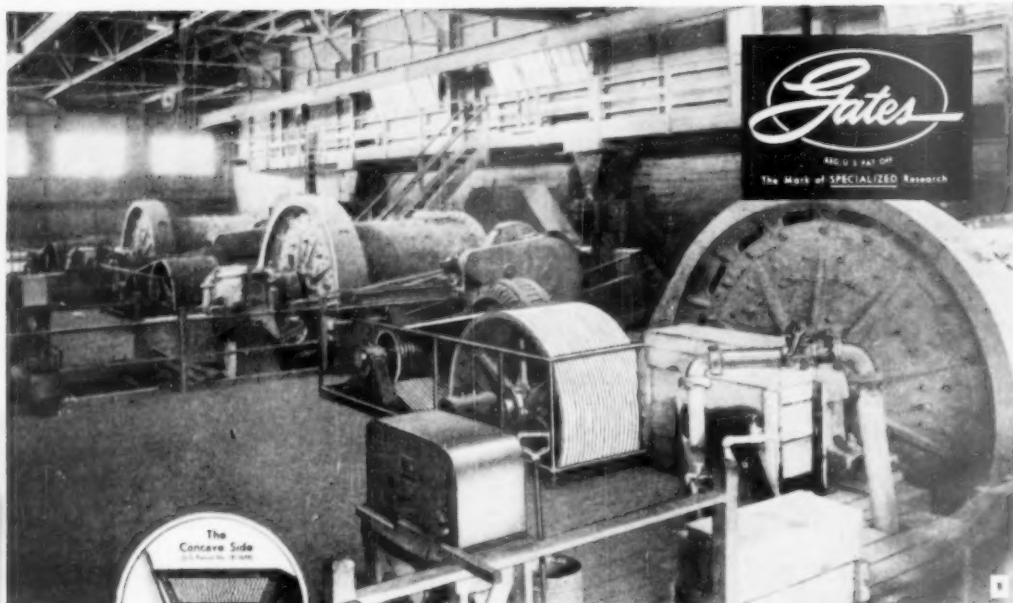
Heavy duty throughout with cast steel rotating base and cast steel machinery side frames. "Feather-Touch" Clutch Control makes operation easy without delicate or complicated mechanisms. Booms can be 30 ft. up to 100 ft. with jib. The Northwest High-Speed Power Controlled Boom Hoist is *independent* of all other operations. Uniform Pressure Swing Clutches take the jerks and grabs out of swinging and conversion to Shovel, Dragline or Pullshovel is accomplished by simply changing booms and without repositioning the base. Add to this the Northwest Carrier, the like of which has never been offered with a Truck Crane before. Heavier duty throughout with better load distribution, better frame reinforcing and outrigger design that assures greater stability during crane operation. We'd like to give you the story in detail. Why not ask for it?

NORTHWEST ENGINEERING CO., 1514 Field Bldg., 135 South LaSalle St., Chicago 3, Ill.

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem





Profits of Bagdad Copper Corporation's isolated Arizona plant depended on maintaining economical and trouble-free operation. They chose the Gates Vulco Rope Drives (shown) for these big ball mills because of their proven ability to handle this rugged service. Also, because the failure of one belt would not necessitate a shutdown, but would give ample notice when a replacement set of belts was needed.

Let this simple test tell you exactly WHY the Concave Side cuts your V-Belt costs

To see for yourself the belt-saving importance of the Concave Side, just pick up any V-belt and bend it as it bends when it goes around a pulley.

As the belt bends, grip its *sides* firmly with your fingers. You will feel the sides of the belt *change shape*. This is because the top of the belt is under tension and, hence, grows *narrower* while the body, under compression, *bulges out*. (See figure 1 and 1-A)

Now look at figures 2 and 2-A. There you see how the bending changes the shape of the belt that is built with the Concave Side—The Gates Vulco Rope. The concave sides of this belt merely *fill out* and become perfectly *straight*. There is no side-bulge. This belt, when bent, *precisely fits its sheave groove*.

A very distinct saving in belt wear results. No side-bulge means that the sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in *longer life* for the sidewall and, naturally, *longer life for the belt*!

If you care about cutting your belt costs, it will pay you to make sure, whenever you buy V-Belts, that you get the V-Belt with the Concave Sides...the Gates Vulco Rope!

What Happens When a V-Belt Bends

Straight-Sided V-Belt



How Straight-Sided V-Belt Bulges in Sheave Groove. Sides Press Unevenly Against V Pulley Causing Extra Wear at Point Shown by Arrows.

Gates Vulco Rope with Concave Side



The Concave Side Fills Out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V Pulley—Uniform Wear—Longer Life!

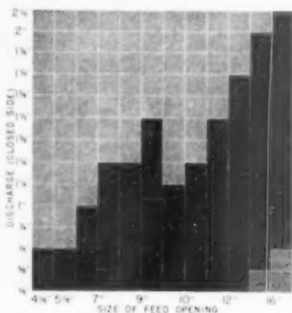
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Beat Increasing Production Costs with Better Equipment

Increased plant efficiency is a logical means of boosting profits in the face of today's rising costs. A major factor in achieving this is mechanical excellence of your equipment. For reduction crushing operations, the Traylor TY Reduction Crusher is unexcelled for capacity and simplicity of design... trouble-free operation with minimum attention and maintenance.



The great working range of Traylor TY Reduction Crushers is shown by this chart. Each bar indicates the degree of adjustment of a Traylor TY Reduction Crusher with a single set of head and concaves. One Traylor TY gives you "job flexibility" greater than several less adjustable machines. This, with the TY's great capacity and low power requirement, will increase your profits.



The non-choking, self-tightening bell head and curved concaves of the Traylor TY Reduction Crusher are clearly shown in this sectional view. These and the all around bottom discharge with no diaphragm are your guarantee of exceptional capacity and choke-free, pack-free operation. Patented dust seal and automatic, force-feed lubrication with a water cooled oil reservoir assure long service with minimum attention.



Bulletin 5112 shows how Traylor TY Reduction Crushers with their non-chokable bell heads and curved concaves... produce greater tonnages of a more uniform product remarkably free from slabs and fines. Booklet contains complete details and specifications. Write for your free copy today.

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3. **MOBILGREASE**—in grades and types for lubrication of all chassis parts, engine accessories.



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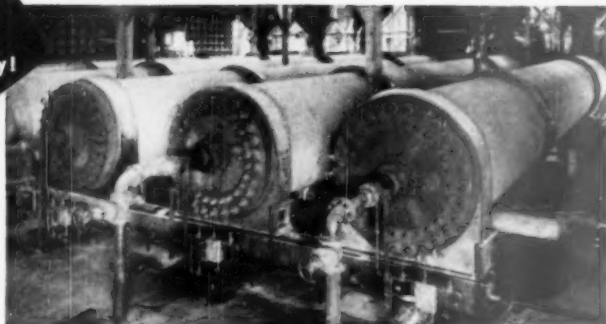
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pay their way

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evaluated in dollars but
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A large company decided to investigate the possible advantages of refining a mined product at its source instead of hundreds of miles away. The purpose was to eliminate considerable freight on water as well as shipping a great quantity of unusable material.

A process was developed which greatly reduced the amount of rejects but it required unusually careful handling in the drying. The problem was

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Obsolete methods may be reducing your profits. Ask for a Louisville engineer to survey your drying processes. There's no obligation.

Other General American Equipment:
Turbo-Mixers, Evaporators, Thickeners,
Dewaterers, Towers, Tanks,
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Over 50 years of creative drying engineering
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Rust-proof your air tools with **GULF ROCK DRILL OIL**



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WHY YOU'LL LIKE IT—

- 1 Nongumming
- 2 High film strength
- 3 Atomizes readily
- 4 Covers completely
- 5 Has low pour point

Yes, you insure freedom from rust when you use Gulf Rock Drill Oil for air operated tools—it contains an effective corrosion inhibitor which keeps moving parts clean as a whistle.

Gulf Rock Drill Oil also has exceptional resistance to oxidation—does not form gummy deposits on internal surfaces of air tools.

Then too, Gulf Rock Drill Oil provides outstanding protection against wear. It has good surface wetting ability—covers completely—and has unusually high film strength.

Gulf Rock Drill Oil has the proper viscosity for this service—atomizes properly in air line oilers—and has a very low pour point. Its use insures cleaner tools, fewer repairs, and lower costs for maintenance.

For further information on Gulf Rock Drill Oil and for expert help on the lubrication and main-

tenance of other types of quarry equipment, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf Office.



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2 GREAT NEW ADDITIONS

**DW20 TRACTOR
W20 WAGON**



**DW21 TRACTOR
NO. 21 SCRAPER**



TO THE "CATERPILLAR" LINE

—TO BRING YOU STILL GREATER EARTHMOVING CAPACITY AND SPEED

Accompanying the Tractor features generalized (below, right) the Wagon member of this big-capacity unit offers:

17 cu. yds. capacity, struck; 25 cu. yds., heaped.

Travel speeds, through tractor's 5 gear ratios, ranging from 2.88 to 26.6 m.p.h.

Generous size hopper to provide good target for shovel or dragline loading.

Controlled dumping . . . openings can be varied without mechanical adjustment—permitting either dumping or windrowing.

Accurate hydraulically controlled dumping with positive mechanical lock on dump doors.

THE DW20 TRACTOR AND NO. 20 SCRAPER UNIT

The "Cat" No. 20 Scraper is available also for the DW20 Tractor. It has the same capacity and general specifications (except in type of gooseneck) as the No. 21 Scraper described below.

THE ENGINE: Both prime movers have the new 6-cylinder "Cat" Diesel Engine . . . 275 HP. peak capacity at 2,000 r.p.m. tested in accordance with A.S.M.E. Power Test Codes; 225 HP. at 1,900 r.p.m. available at the flywheel.

Accompanying the Tractor features generalized (right), the 2-wheel DW21 offers:

Full 90° turn each way.

Travel speeds, through 5 gear ratios, ranging from 2.16 to 20 m.p.h.

Scraper capacity is 15 cu. yds., struck; 19½ cu. yds., heaped. (With available 12" extensions, 18 cu. yds., struck; 22½ cu. yds., heaped.)

Bowl and apron are designed to promote "boiling" action of earth through center of load—for full-measure yardage and minimum loading time.

Large low-pressure tires for easy load flotation.

'Dozer-type ejection for positive "kicking out" of sticky material; dependable spring-action ejector return.

Open bowl design to permit visible loading under shovel or dragline.

Adjustable rear axle to permit level cuts and desired settings.

Double bottom of special alloy steel. Self-sharpening reversible cutting edge.

High apron lift, low center of gravity.

FOR high-speed hauling . . . for high production . . . "Caterpillar" offers two new earthmoving units—the 4-wheel DW20 and the 2-wheel DW21.

With a completely new 6-cylinder Diesel Engine producing 225 HP. available at the flywheel, the newcomers give users their choice of high-speed wheel-type prime movers.

The DW20, with top speed of 26.6 m.p.h., has 2 design matched trailed units . . . the "Cat" W20 Wagon (25 cu. yds. heaped capacity) and the "Cat" No. 20 Scraper (19½ cu. yds. heaped capacity).

The DW21, with top speed of 20 m.p.h., trails the "Cat" No. 21 Scraper (19½ cu. yds. heaped capacity).

And, as always, "Caterpillar" quality, dependability, durability and work capacity are built in . . . backed by the unparalleled parts and service facilities of the worldwide "Caterpillar" dealer organization.

For further information on these two new units, contact your dealer or write the factory.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

TRANSMISSION

Constant-mesh transmission, and heavy-duty clutch. Special locking device that prevents gears from becoming disengaged.

BRAKES

Each large, heavy-duty brake is 22" in diameter, 7" wide. Compressed air energized brakes on both tractor and drawn member of unit. Handy control valves for applying both sets of brakes, and to right or left driving wheel.

STEERING

Hydraulic booster steering that follows the natural "feel of the road" hand guidance. Heavy steel stops for keeping gooseneck of drawn equipment from jackknifing.

OPERATOR COMFORT

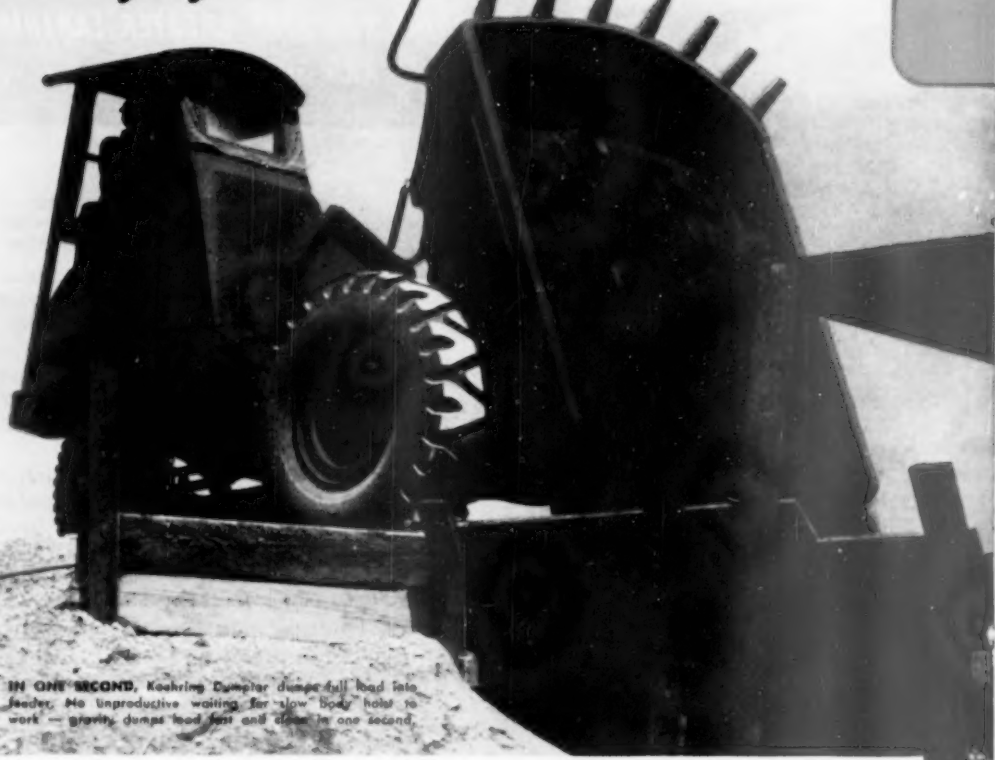
Airfoam rubber cushion on bucket-type seat mounted on coil spring with hydraulic snubber. All controls within easy reach. Excellent visibility.

CATERPILLAR

DIESEL ENGINES • TRACTORS
MOTOR GRADERS • EARTHMOVING EQUIPMENT

FOR

Bigger Output



IN ONE SECOND, Koehring Dumper dumps full load into loader. No unproductive waiting for slow body hoist to work — gravity dumps load fast and clean in one second.



STEEP GRADES — Ability to pull full loads up grades to 24% make Dumpsters especially suitable for heavy hauling out of pits. Sturdy hydraulic brakes give complete control on steep down hill runs. Parking brake is independent.



ROUGH HAUL ROADS don't slow up Dumpsters. Ruts won't twist heavy-duty frame because steering axle oscillates as much as 21" — takes the strains out of rough mine road travel. Big tires help cushion shocks, give better traction, flotation.



in mines, pits and quarries

KOEHRING DUMPTORS

load FASTER • haul FASTER • dump FASTER

ON typical, rough, off-road hauls, you can increase trips per hour, yardage per day and reduce maintenance problems with Koehring heavy-duty, 6-yard Dumptors. Here's why:

Short Turning Radius, Big Target SAVE SPOT AND LOAD TIME

Short, 19'6" turning radius and compact design let Dumptors get close in under shovel . . . save jockeying back and forth. Big, 64 square-foot body opening provides an easy-to-hit target. Result—increased shovel production, more haul-time, less spot and load time.

Heavy-Duty 6-Yard Body BUILT FOR HEAVY ROCK SERVICE

To take severest shocks of shovel-loading, all-welded Dumptors are heavily ribbed with 4" channels. Bottom of seasoned 1-3/4" oak timbers, between two 5 x 16" steel plates, cushions load shocks. In heavy mine and quarry service, Dumptors give you less down-time, more work-time, year in, year out with less maintenance care.

Ton of Strength per Ton of Payload SPEEDS TRAVEL ON ROUGH HAULS

Koehring Dumptors have rugged 8" ship channel main frame, heavily trussed . . . 4" chrome steel drive axles . . . cast alloy-steel "I" beam steering axle, that take the twists and strains of fast off-road travel. Big rugged

tires take road shocks. There are no leaf springs . . . Dumptors need only one big double-coil spring, on steering axle. You have NO spring maintenance.

6 HP for Every Ton of Gross Weight GIVES GREATER GRADE-ABILITY

Dumptors have 6 HP for every ton of gross vehicle weight. That means more "GO," more acceleration, less shifting on grades. Also, plenty of power to climb grades to 24% with full load. Dumptors are built to stand up under the toughest hauling of mine and quarry service.

No Slow, Troublesome Body Hoists . . . DUMPTOR DUMPS IN ONE SECOND

At the dump, gravity dumps load . . . fast. One second and body is empty . . . you're on the way for another load. You save 15 to 25 seconds every dump. No mechanical complications . . . no body hoist maintenance. Free-swinging kick-out pan breaks suction of sticky materials . . . adds 3, 16" of steel to strength of Dumptors bottom.

No-Turn Shuttle Operation SAVES SLOW TURNS EVERY TRIP

Because Koehring constant-mesh transmission makes same 3 speeds available in both directions, Dumptors are never turned on shuttle hauls. On a 1,000' haul (16 round trips per hour), this gains 8 minutes every hour. Let your Koehring distributor show you what Dumptors can do to save money in your mine, pit or quarry.



Koehring 605 Rock Shovel Keeps Pace with Fast Dumptors Hauling Speed . . .

For balanced, high-production teamwork on both your excavating and hauling operations, team up your Dumptors with the Koehring heavy-duty 605 Rock Shovel. Its fast operating speeds . . . big 1 1/2-yard dipper capacity . . . rugged, extra strong boom, with shock-absorber mount . . . and big, power-operated clutches, all keep production high, costs low. Your Koehring distributor also can show you heavy-duty Koehring excavators in 1/2-yard, 3/4-yard, 2 1/2-yard sizes to satisfy your exact requirements. ASK, TOO, FOR CATALOG ON 2 1/2-YARD 1005

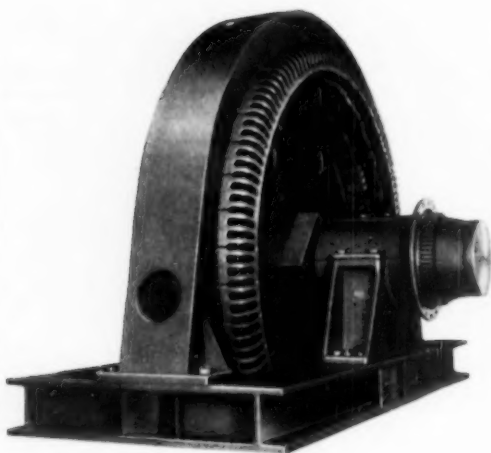
KOEHRING COMPANY, Milwaukee 10, Wisconsin

Subsidiaries: JOHNSON • KWIK-MIX • PARSONS

DUMPTOR—Trademark Reg. U. S. Pat. Off. K836

Save on original costs

use G-E synchronous



You'll save money in many applications when you specify General Electric synchronous motors. The chart shows (ratings above the black line) the applications where synchronous motors (including control and exciter) have a lower first cost than any other kind of motor. And even in cases where there is no original saving (between red and black lines) you can save on over-all cost by specifying synchronous motors to increase operating efficiency and improve power factor.

When you specify G-E synchronous motors, you get application engineering by experts in the electrical problems of *your* industry. You get the motor that gives you greatest return on your investment.

For your next large, constant-speed motor, ask your General Electric sales representative to tell you how you can take full advantage of the money-saving features of G-E synchronous motors. Or write for bulletins on your letterhead to *Section 770-17, Apparatus Dept., General Electric Co., Schenectady 5, N.Y.*

Low speed . . . GEA-5332 High speed . . . GEA-5426
Control . . . GEC-505

PROTECT YOUR SAVINGS WITH

G-E SYNCHRONOUS MOTOR CONTROL

New rotor field circuit provides accurate field application—motor is protected against starting shock.

New rotor field circuit keeps constant check on motor performance and, on pull-out, field is removed before first slip cycle is completed—to protect against electrical and mechanical damage.

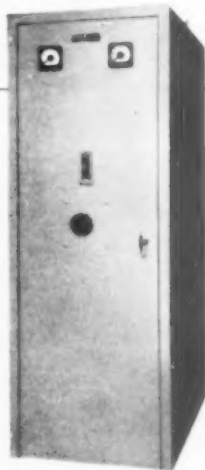
In addition to the protection offered by the new rotor field circuit, the new, smaller air-break limitamp controller provides fast-acting FJ-2 fuses that limit short circuits to less than one-half cycle for motors up to 5000 volts.

Low-voltage motors (up to 600

volts) are protected by compact, easily inspected air-circuit breakers.

To make it easier to install, to adjust, to operate, and to service, G-E synchronous control is factory-mounted in a steel enclosure with anti-glare meters and all the built-in accessories required for your application.

Come to General Electric for the engineering and manufacturing that will assure you of adequate protection of your motor and plant investment. Write for more information on this precise motor control.



GENERAL  ELECTRIC

770-47

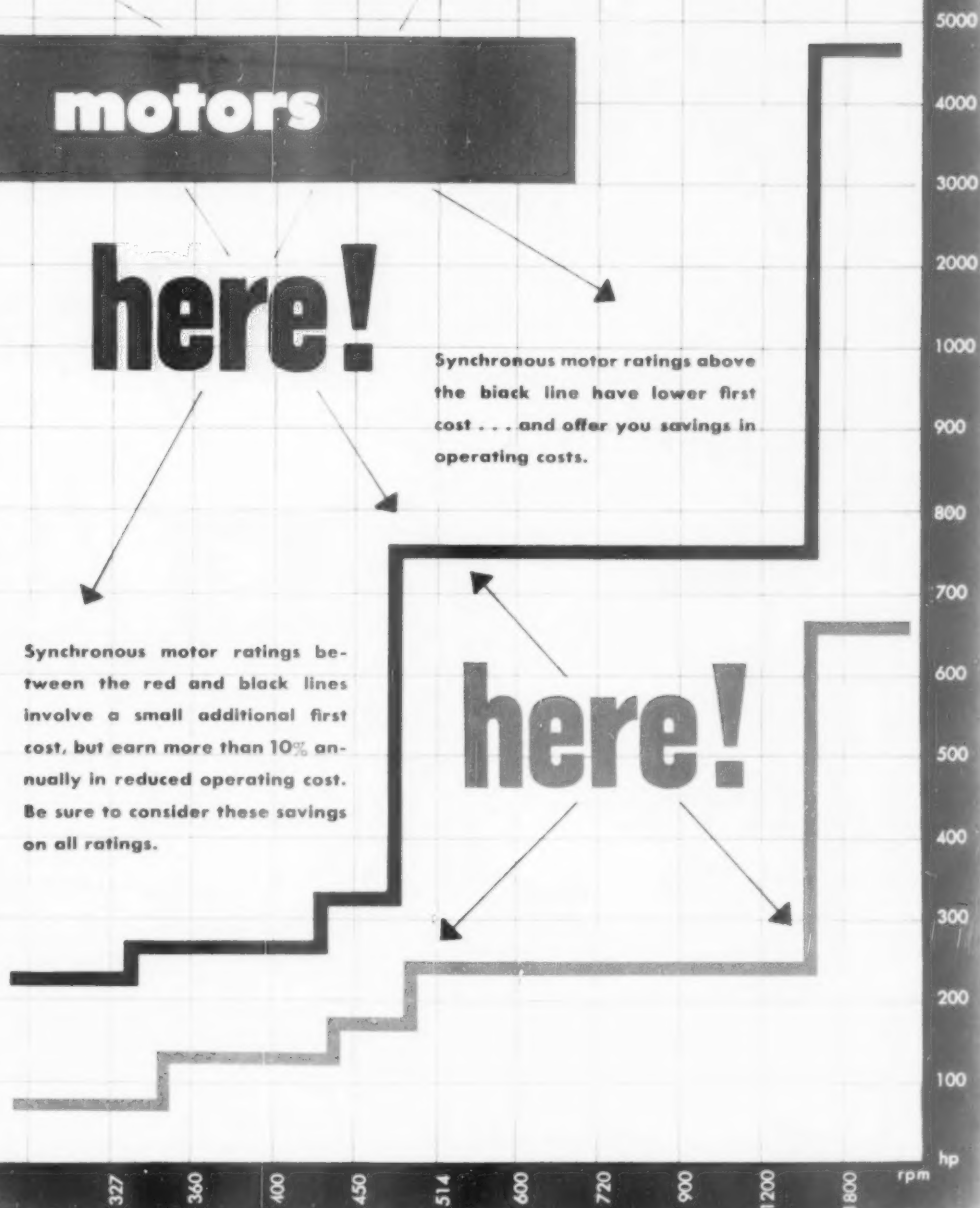
motors

here!

Synchronous motor ratings above the black line have lower first cost . . . and offer you savings in operating costs.

Synchronous motor ratings between the red and black lines involve a small additional first cost, but earn more than 10% annually in reduced operating cost. Be sure to consider these savings on all ratings.

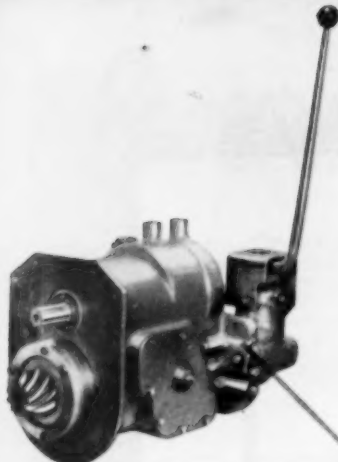
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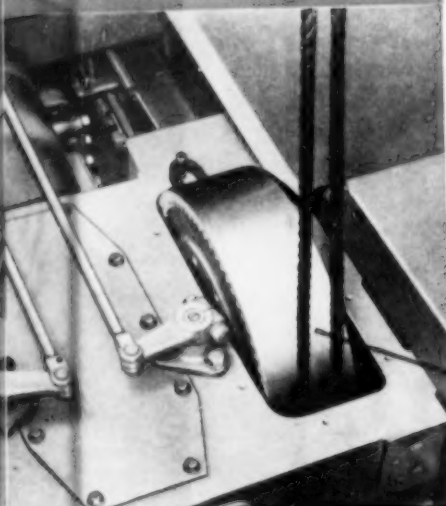
Allis-
Chalmers

Design

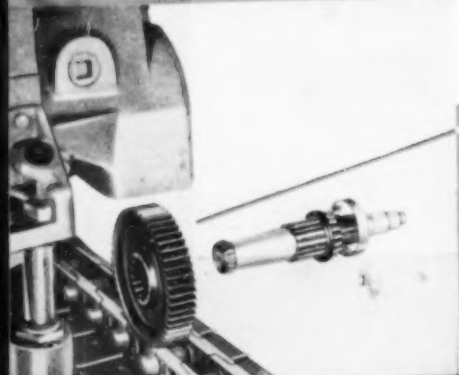
Another big reason why
HD-5
leads in tractor output



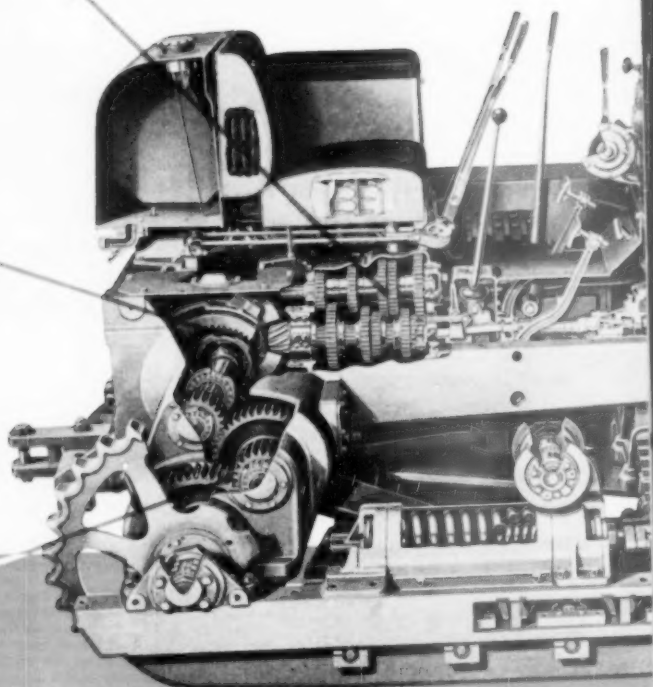
Transmission can be removed as a complete unit without removing clutch, final drive or bevel gear.



Each steering clutch can be removed independently and without removing final drive pinion or bevel gear.



Final drive gear and intermediate gear can be removed without disturbing steering clutch.



More Reasons For HD-5 Top Performance

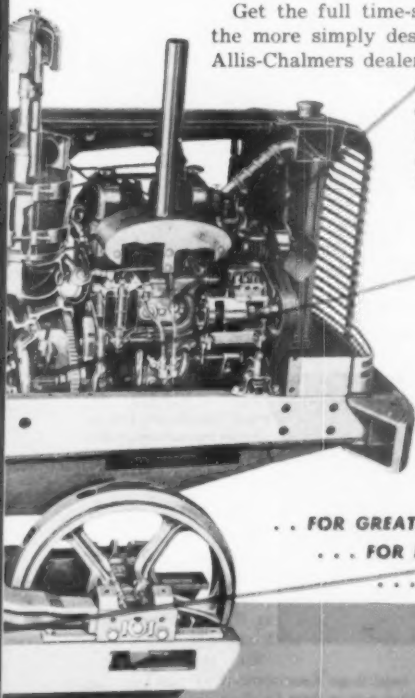
- ✓ Exclusive Positive Seal 1,000-Hour Lubrication of truck wheels, track idlers and support rollers
- ✓ 11,000 lb. of Balanced Weight
- ✓ Greater Operator Comfort
- ✓ 2-Cycle Diesel Engine — 40.26 drawbar hp.

Simplicity

Simple unit assembly is another important reason why the HD-5 is low in total down time required for servicing and maintenance — why it is tops in output per day, per month, per season.

When maintenance is necessary, each assembly is readily accessible for attention. The HD-5 is designed so that each major unit may be easily removed and repaired or replaced *right on the job* without removing unrelated parts. The time and labor saved means substantial increases in the HD-5's overall output. Remember — a tractor makes money for an owner only when it's working!

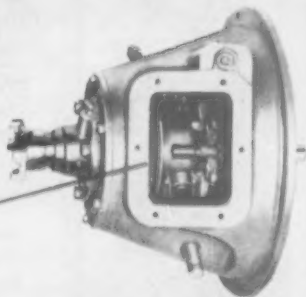
Get the full time-saving service story on the more simply designed HD-5 from your Allis-Chalmers dealer . . . NOW! Ask him, too, for a practical demonstration . . . a demonstration under your own operating conditions. "Seeing Is Believing."



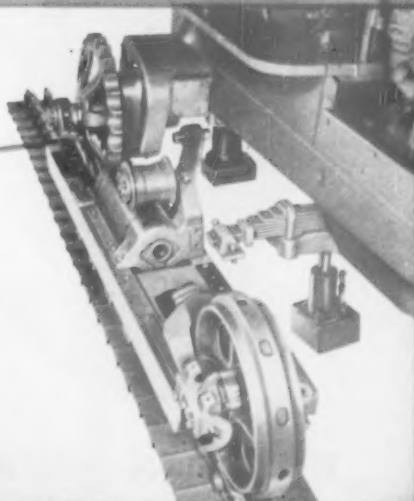
- ... FOR GREATER PRODUCTION
- ... FOR EASIER OPERATION
- ... FOR SIMPLIFIED SERVICING



Engine can be removed without disassembling clutch.



Clutch assembly can be removed without disturbing engine or transmission.



Truck frame can be dismantled without removing final drive, speedster or equalizer spring.

ALLIS-CHALMERS
MILWAUKEE, U.S.A.
TRACTOR DIVISION



Switch

to this new

PLASTIC Reinforced

PRIMACORD

in place of Wire Countered.

Field tested for over a year — where the going is toughest — the new PLASTIC Reinforced Primacord showed itself far superior to Wire Countered Primacord. Yet it costs no more!

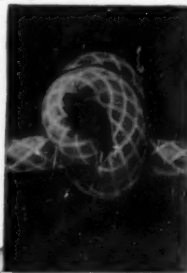
Reinforced with rayon yarn, it is stronger and lighter in weight. Finished with a smooth, tough seamless plastic covering, it is waterproof and resistant to acids encountered in mineral ores. It does not become brittle or crack in cold weather, nor is it affected on hot summer days, and it is not a conductor of electricity.

PLASTIC-Reinforced Primacord is your best bet in all deep, wet holes — in preloading, pipe line river crossings, horizontal holes, marine work, coyote tunnels and sleeper shots for seismograph work.



Plastic Reinforced Primacord is recommended for "down" lines where you formerly used Wire Countered Primacord.

1. To make the most effective hookup, use a simple clove hitch in the ground line, as shown in these three photographs.



2. The twin loops have been folded over to form a hole.



3. Pass the Plastic Reinforced Primacord through this hole and draw the knot up tight.

THE ENSIGN

BICKFORD COMPANY • SIMSBURY, CONN.

PRIMACORD-BICKFORD DETONATING FUSE • SAFETY FUSE SINCE 1836

NOW! New Smoother Running Gear

LASTS LONGER • CUTS COSTS



Trailing tooth picks up load before preceding tooth loses contact.



There's more area for tooth contact with 20° long addendum tooth.



No gouging when gear tooth pulls away from pinion.

Big news for operators of grinding mills, rotary kilns, coolers, dryers! Allis-Chalmers offers new 20° involute cut tooth spur gear . . . developed after a comparative survey proved these gears the most effective for smooth operation and long gear life.

HERE'S WHY new 20° involute spur gear with long addendum pinion and short addendum gear tooth results in smooth, even distribution of force from pinion to gear:

1) Gear tooth *rolls* evenly on pinion tooth, not first rolling and then sliding. 2) Rolling action results in least friction wear. Pressure is lower because working force is distributed over 75% more tooth area. 3) Each gear tooth is 25% thicker at base, 25% stronger per inch of gear face.

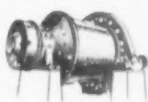
Gear teeth cannot rub on following pinion tooth when it pulls away on turn. Each gear tooth is a true

involute shape, cut on precision machines and rigidly inspected to assure large gears of high accuracy.

This improved gear is standard on new A-C equipment; can, in many cases, be obtained to replace existing gears without changing center to center distances. For more facts, call the Allis-Chalmers man in your area.

ALLIS-CHALMERS, 975A SO. 70 ST.
MILWAUKEE, WIS.

Designed especially for equipment in the cement, mining and milling industries.



Grinding Mills



Rotary Kilns

Also used on rotary dryers, coolers, blade mills, etc.

ALLIS-CHALMERS

Texrapo is an Allis-Chalmers trademark

A3130

Sales Offices in
Principal Cities in
the U. S. A. Distributors
Throughout the World.



Motors



Controls



Texrapo Drives



Vibrating Screens



Crushers



Kilns, Coolers, Dryers





THE NEED --- Fast, economical switching THE ANSWER --- PLYMOUTH LOCOMOTIVES!

Throughout American industry you'll find **PLYMOUTH LOCOMOTIVES** on the job — speeding up production, cutting hauling costs.

Company after company has discovered the advantages — extra power — low fuel consumption — maneuverability on grades and curves — time-defying construction of Plymouth. Records of satisfied operators show hauling costs cut 66 $\frac{2}{3}$ %; dependable performance for 27 years and still going strong; only .003% time out for maintenance in 7400 hours of operation.*

Hauling tons and tons of ashes in a never-ending stream from the Ohio Edison Company's power plant at Dilles Bottom, Ohio, this powerful diesel locomotive is one of many Plymouths helping to produce economical haulage power for companies everywhere.

Gasoline, diesel, diesel-electric — standard and narrow gauge — 2 $\frac{1}{2}$ to 70-ton **PLYMOUTH LOCOMOTIVES** are filling an essential need today wherever fast, economical switching is required. There's a **PLYMOUTH** for your needs, too!

(*Names of companies on request)

INDUSTRIES' FAVORITE SWITCHERS



GET THE FACTS about Plymouth Power and economy now! Send your requirements to: **PLYMOUTH LOCOMOTIVE WORKS**, Division of **THE FATE-ROOT-HEATH COMPANY**, DEPT. A-5, PLYMOUTH, OHIO.

PLYMOUTH LOCOMOTIVES

GASOLINE, DIESEL, AND DIESEL ELECTRIC

PLYMOUTH LOCOMOTIVE WORKS • Division of The Fate-Root-Heath Co., Plymouth, Ohio, U.S.A.

"GUILLOTINE" TEST

Proves 50% MORE CUSHION in *Homocord* CONVEYOR BELTS



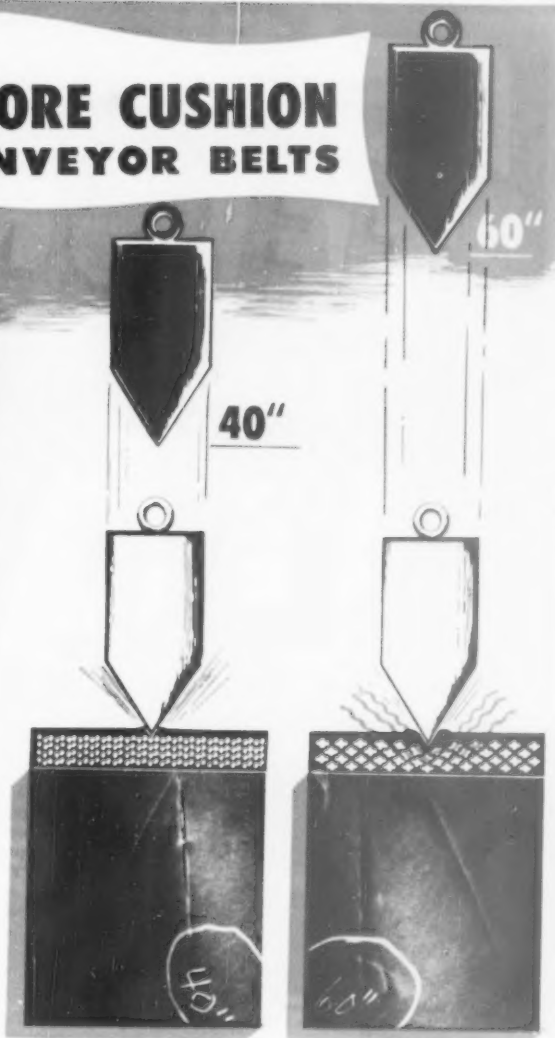
When rocks like those shown here drop on a conveyor belt, every shock at loading point shortens the life of the belt. To overcome this, extreme cushion and resilience are built into Homocord Conveyor Belts. This "Through-and-Through" Cushion gives Homocord Conveyor Belts longer life than any other belt.

To measure comparative cushion and shock-absorbing qualities, Raybestos-Manhattan engineers devised the "killer" test shown at right. A heavy metal weight, ground to a blunt edge is dropped from various measured heights until it ruptures the cover of the sample under test.

Notice the shock lines indicate how a regular conveyor belt's "boardy" resistance to impact leads to cover gouging and breakdown. The shock lines on the Homocord cross section show how "Through-and-Through" cushion and resilience of the Homocords absorb impact without injury.

Homocord CUSHIONED CONSTRUCTION HAS 8 ADVANTAGES

1. Complete bonding of every member into a homogeneous structure.
2. Holds metal fasteners, with no loss of draw-bar strength.
3. Lateral flexibility permits perfect troughing, accurate training, reduces fatigue of flexing at bend in troughing idlers.
4. Resists destructive action of continuous or heavy impact feeding.
5. Cushion Homocord body and low inelastic stretch reduce wear and tear of top cover.
6. Homocord body reduces hazard of punctures.
7. The Homocords are completely encased in Flexlastics; moisture not admitted, mildew cannot start.
8. Longer life, lower cost per ton.



REGULAR DUCK BELT

Untouched photo shows actual rupture results of a 40" Guillotine Drop Test on a conventional 4-ply 32-oz. duck belt with 1/8" top cover, 1/16" bottom cover. With little cushion to absorb impact, the cover ruptures and deterioration sets in.

Homocord

Untouched photo shows comparable degree of impact effect from a 60" Guillotine Drop Test on a 4-ply AEH Homocord Conveyor Belt with 1/8" top cover and 1/16" bottom cover. Impact of falling weight is dissipated through the Homocords, cushioned in Flexlastics.

MANHATTAN RUBBER DIVISION - PATENT NEW JERSEY



RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

ROCK PRODUCTS, October, 1950

TELSMITH EQUIPMENT FOR DAMS



400,000 TONS

TVA's Watauga Dam, Tenn. Four different types of Telsmith Crushers used on this job.



1,500,000 TONS

Center Hill Dam, Tenn. Telsmith designed complete crushing-screening plant, and furnished most of the equipment.

● Huge dam projects and Telsmith Aggregate Plants go together. Many dam builders call in Telsmith engineers right at the start—for consultation as to the proper plant layout and the right equipment to use. Then Telsmith makes the detailed drawings for the erection of the plant and furnishes most of the machinery. Telsmith designed plants have proven their efficiency on many large projects and Telsmith equipment has a world-wide reputation for the production of low-cost aggregate. The ruggedness of Telsmith equipment is strikingly demonstrated by long life in severest service, on successive projects. After producing 1,500,000 tons of aggregate at Center Hill Dam, the same Telsmith equipment is now turning out about the same amount of aggregate at Buggs Island Dam.



1,250,000 TONS

Buggs Island Dam, Va. This Telsmith crushing plant also produced the aggregate for Center Hill Dam.

Save TIME and MONEY

Consult Telsmith Engineers—
Ask for Bulletins 266 and 271



2,500,000 TONS

Nerf Dam, Ark. This 500 ton per hr. capacity combination quarry and sand and gravel plant was Telsmith designed and equipped.



600,000 TONS

Philpott Dam, Va. Here, too, the crushing-screening equipment is Telsmith.



1,500,000 TONS

Mount Morris, Dam, N. Y. The 300-350 tons per hour rock crushing plant is Telsmith designed and equipped.

OTHER DAMS BUILT WITH TELSMITH EQUIPMENT

- Alatoona Dam, Georgia
- Ariel Dam, Ariel, Wash.
- Boysen Dam, Shoshoni, Wyo.
- Carpenter Dam, Arkansas
- Cascade Dam, Washington
- Clark Hill Dam, Augusta, Ga.
- Conowingo Dam, Conowingo, Md.
- Dale Hollow Dam, Tennessee
- Davis Dam, Nevada
- El Presidente Dam, Mexico
- Fort Gibson Dam, Oklahoma
- Grand Coulee Dam, Washington
- Kortes Dam, Wyoming
- Morony Dam, Montana
- South Holston Dam, Tennessee

65-11

SMITH ENGINEERING WORKS
508 EAST CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Cable Address: Sengworks, Milwaukee

31 East 42nd St. New York 17, N. Y.	211 W. Wacker Drive Chicago 6, Ill.	713 Commercial Trust Bldg. Philadelphia 2, Pa.	238 Main Street Cambridge 42, Mass.	Boehk Ept. Co. Milwaukee 3, Wis.	A. N. Wigle, 362 S. Ashburton Rd. Columbus 13, Ohio
Uyde Equipment Co., Portland 9, Ore. & Seattle 4, Wash.	Mines Eng. & Ept. Co., San Francisco 4, Calif.	Interstate Equipment Co., Statesville, N. C.	Rish Equipment Co., Charleston 22 & Clarkburg, W. Va.	Roanoke 7, & Richmond 16, Va.	Wilson-Weener-Wilkinson Co., Knoxville 8 & Nashville 6, Tenn.



Short Costs FOR THE **Long Haul!**

Economical material handling—movement of mass—has long been the chief concern of S-A designers and engineers! . . . Whether the haul be long or short, up or down, over land or through tunnels—S-A has a wealth of experience to draw on in finding the right answer!

If you have a bulk handling problem it will pay you to consult with S-A engineers—specialists who have proved their ability to move material of the required volume at the lowest cost per ton! . . . It costs you nothing to find out—write today.

The 24" wide elevated belt conveyor is 1430 feet long—supported for nearly its entire length on steel frames and towers. It conveys crushed rock from the storage building to large silos at about 150 tons per hour. It passes over two plant roads and a railroad siding without obstructing traffic. This belt conveyor was designed and installed by S-A to provide long distance handling at lowest cost per ton.

STEPHEN S-A DAMSON

7 Ridgeway Avenue, Aurora, Illinois MFG. CO. Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

CRUSH

AND

TRAVEL

UNIVERSAL "TRAVELER"

CRUSHING, SCREENING AND LOADING PLANTS



TS-TRAVELER—Screens finished pit run, crushes oversize. Blends and loads. Available in 916, 1016, 1020 or 1024 sizes with bronze or roller bearing jaw crushers.



CSE-TRAVELER—Closed circuit plant with bucket elevator return from crusher to screen. Produces specification material. Available in 916, 1016, 1020 or 1024 sizes with bronze or roller bearing jaw crushers.



CS-TRAVELER—Screens out finished pit run, crushes oversize. Mixes and loads. Available in 916, 1016, 1020 or 1024 sizes with bronze or roller bearing jaw crushers.

Enjoy rock bottom aggregate costs where production requirements are moderate. Here are three low priced units from the complete line of famous Universal crushing plants. You get advanced engineering design for top efficiency and economy. Simplicity of construction provides easy operation with minimum man-power. The sturdy Universal overhead eccentric jaw crusher with its double crushing action and force discharge of material gives you greater crushing capacity.

Designed for "crush-and-travel" operations, Universal TRAVELER plants are ideal for building access roads to backwoods locations, as well as logging and oil field operations. Also for secondary road construction and maintenance work.

GET FULL DETAILS
WRITE FOR BULLETINS

PRICES

START AS LOW AS

\$8632⁰⁰

F. O. B. Factory—Complete with Power

UNIVERSAL ENGINEERING CORP. division of PETTIBONE MULLIKEN CORP.

617 C Avenue N. W., Cedar Rapids, Iowa

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4700 W. Division St., Chicago 51, Illinois

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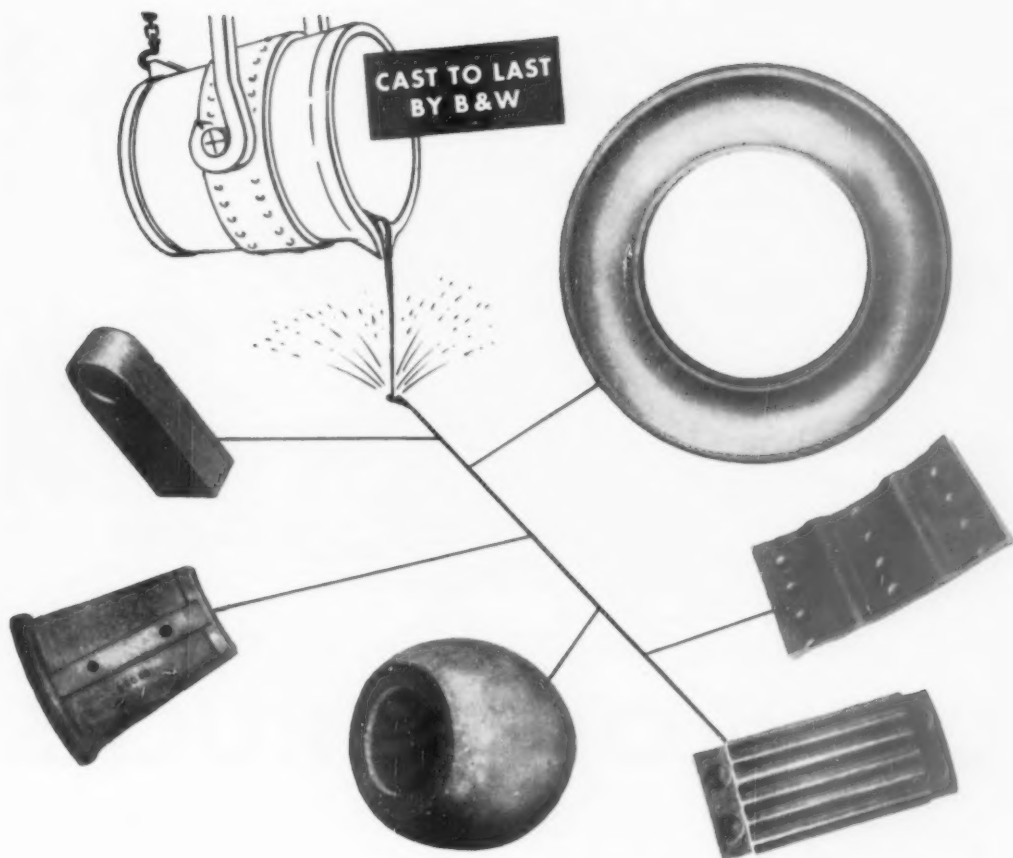
Pace-Setter in ROCK

The modern Bucyrus-Erie 100-B shovel is proving again that in hard digging it sets the pace for quarry and mine excavators in its class. Traditionally, Bucyrus-Eries are *years ahead* — in performance, in durability, in significant design improvements that spell increased production with greater econ-

omy of operation. Today, as always, it pays to investigate the Bucyrus-Erie quarry and mining machines. Capacities from 2½ to 36 cubic yards.



SOUTH MILWAUKEE, WISCONSIN



Service-proved AIDS to low-cost grinding

B&W chilled iron and alloy steel wear-resistant castings have a long and favorable service record as vital parts of widely-used types of grinding equipment. Because they are **CAST TO LAST** under all kinds of abrasive conditions encountered in rock products plants, liners, roll heads, slugger plates and other B&W wear metal castings keep grinding and crushing equipment on the job . . . prevent unscheduled shutdowns for costly, time-consuming repairs and replacements. Secret of their superlative service life is the unique properties of B&W Elverite A and Elverite C chilled irons, and B&W Steel Alloy 5202. Each has distinct advantages for specific operating requirements of strength and abrasion resistance. Let B&W pour longer life into your next order of wear-resistant castings for new equipment or renewals. Chances are our large pattern stock includes your designs.





Get a better day's work out of your Truck Dollar

CHEVROLET TRUCKS



You invest money in a truck to get work done. And you can prove to your own satisfaction that a Chevrolet truck does more work for every dollar you put into it.

You get *more for your money* right from the start, because your Chevrolet truck is priced at rock bottom. Chevrolet volume production—far and away the biggest in the truck field—makes possible extra features and extra engineering advantages at lowest cost.

You get *more for your money* every driving mile, because Chevrolet trucks are economical to operate. The top-rated efficiency of Chevrolet Valve-in-Head engine design saves money on gas and oil day in, day out.

You get *more for your money* right through the years, because your Chevrolet truck cuts upkeep to the bone. Hypoid rear axles, diaphragm spring clutch, ball-type steering and many other great truck features help keep your truck on the job and out of the shop.

Get the full "more-work-per-dollar" story from your Chevrolet dealer—and get America's biggest selling, best performing truck: Chevrolet.

CHEVROLET MOTOR DIVISION, General Motors Corporation
DETROIT 2, MICHIGAN

These Great Features Help Tell Why CHEVROLET TRUCKS ARE THE FIRST CHOICE OF TRUCK BUYERS EVERYWHERE

TWO GREAT VALVE-IN-HEAD ENGINES: the new Loadmaster and the improved Thriftmaster—to give you greater power per gallon, lower cost per load • **THE NEW POWER-JET CARBURETOR:** smoother, quicker acceleration response • **DIAPHRAGM SPRING CLUTCH** for easy-action engagement • **SYNCHROMESH TRANSMISSIONS** for fast, smooth shifting • **HYPOID REAR AXLES**—5 times more durable than spiral bevel type • **DOUBLE-ARTICULATED BRAKES**—for complete driver control • **WIDE-BASE WHEELS** for increased tire mileage • **ADVANCE-DESIGN STYLING** with the "Cab that Breathes" • **BALL-TYPE STEERING** for easier handling • **UNIT-DESIGN BODIES**—precision built.

\$10,000 SAVED ANNUALLY

on a \$12,600 investment

\$3,500 SAVED ANNUALLY

on a \$4,200 investment

These are actual Case Histories

CASE HISTORY No. 1

With a New Bulldog Hammermill crushing 20" and under Fuller's Earth, 50% moisture

Before

Operation required one primary double roll, 8 screens, two secondary double rolls, with auxiliary equipment.

Continuous clogging produced irregular finished product, consumed excessive fuel in drying, extruding operations expensive.

After

Installing one Bulldog Hammermill. One stage operation, no clogging — no delays or shut-downs.

Now produces a uniform cubical product easily dried, saving fuel.

Saves labor, maintenance, fuel and produces a better finished product.

CASE HISTORY No. 2

Rebuilding an existing operating Hammermill crushing Limestone for cement

Before

Maintenance required replacement of 26,400 lbs. of manganese steel hammers and 12 sets of hammer bolts annually.

Load capacity required extra operating hours. Primary grinding was not suitable for final roll type pulverizer.

After

With Bulldog rebuilding, the Hammer replacement was reduced to 3,600 lbs. manganese steel and one set of hammer bolts per year.

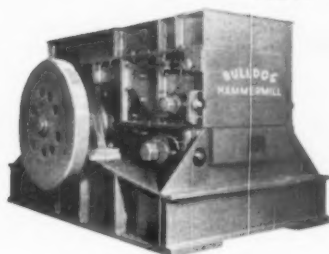
Capacity increased 30% with less power consumption, better finished product saving power and maintenance in roll type pulverizer.

Second Hammermill purchased as a result of savings.

CAN YOU CUT COSTS — INCREASE CAPACITY — IMPROVE PRODUCT

with a

NEW BULLDOG HAMMERMILL



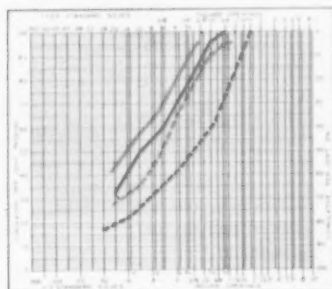
Compare your crushing operation with the actual proven results charted at right.

Solid red line indicates material from Bulldog Hammermill with screens in closed circuit.

Dotted red line shows Bulldog Hammermill no screens, open crushing.

Solid black line indicates standard impactor with screens in closed circuit.

Dotted black line indicates standard hammermill no screens, open crushing.



Bulldog Hammermills with Non Clog Moving Breaker Plate for sticky or high moisture materials or with Stationary Breaker Plate for dry materials are built in all sizes up to 72" x 60" for primary, secondary and fine reduction. Write for complete details.

A PRODUCT OF PETTIBONE MULLIKEN CORPORATION

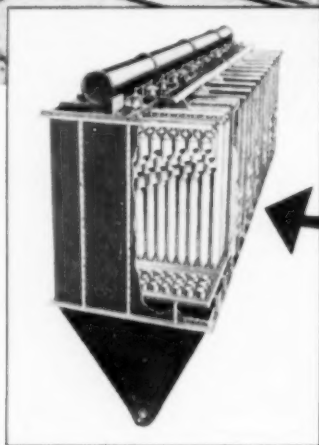
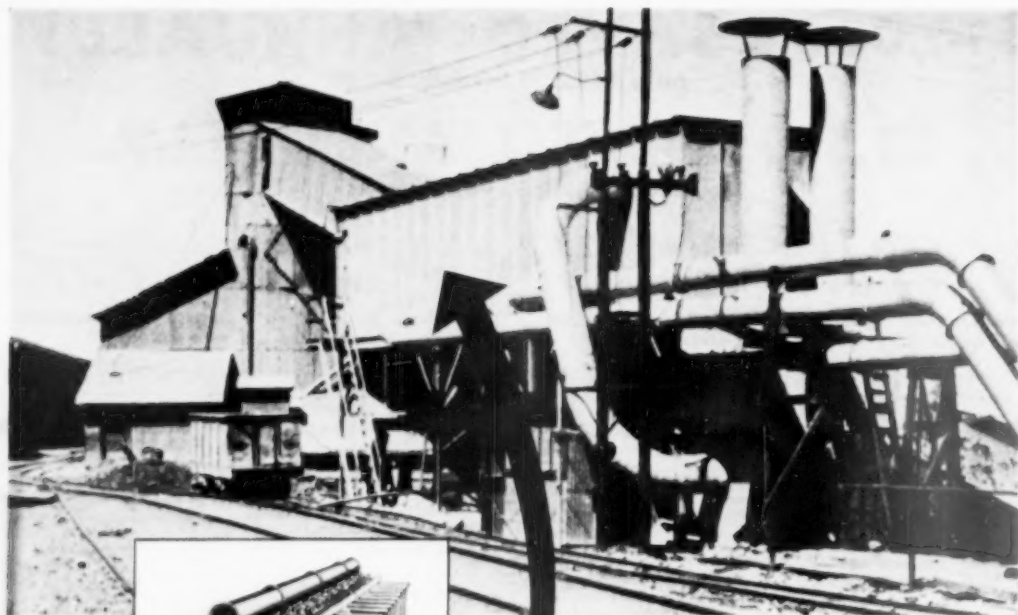
Hammermills, Inc. is now a division of Pettibone Mulliken Corp., and has the tremendous facilities of PMCO, to back our products . . . with full control over research, construction and fabrication combined under one roof.

HAMMERMILLS, INC.
4760 W. Division St.
Chicago 51, Ill.
Phone Spaulding 2-9300

division of

PETTIBONE MULLIKEN CORP.
4700 W. Division St.,
Chicago 51, Ill.
Phone Spaulding 2-9300





Norblo Bag Type

DUST AND FUME COLLECTION

One particular Norblo installation of Norblo Automatic Bag Type Dust Collectors (in tandem) moves more than four million tons of air a year. This unit is collecting a scarce and valuable metal previously recovered less efficiently. The difference represents a substantial increase in profit.

Pre-eminent in the smelting, mining, cement and rock products fields, Norblo Automatic Bag Type Dust and Fume Collection provides dependable, heavy duty continuous service at low cost. In the smelting field right now the extra production capacity of Norblo automatics is paying off handsomely. Write for Bulletin No. 164-2 - today!

tackles the biggest jobs...

production at low cost

THE NORTHERN BLOWER COMPANY

6408 BARBERTON AVENUE

CLEVELAND 2, OHIO

Automatic and Standard Bag Type Fume and Dust Collectors • Norblo Centrifugal and Hydraulic Collectors • Cement Air Cooling Systems • Exhaust Fans

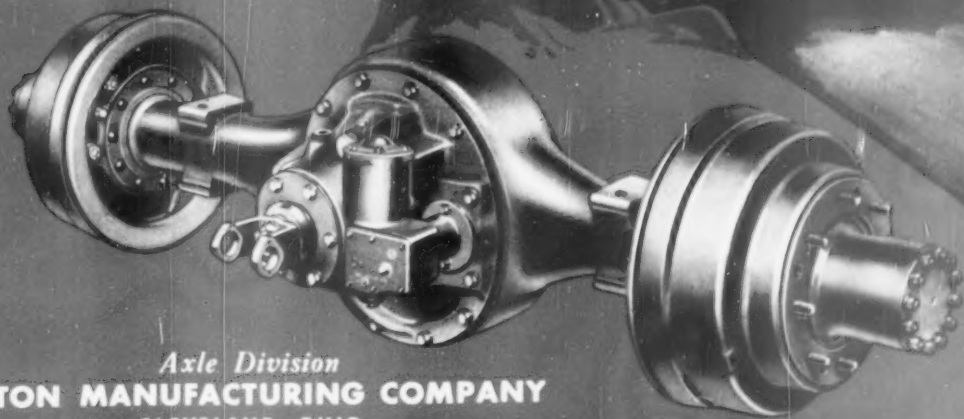
EATON

2-Speed Trucks

AXLES

Give More Pay-Load Miles at Lower Cost per Mile

Trucks equipped with Eaton 2-Speed Axles make fewer stops for gas and oil. That's because these Eaton Axles double the number of available gear ratios in any truck, thus permitting the use of the most efficient ratio for every driving condition. As a result, the engine operates at economical speeds—doesn't strain and struggle on hills or when starting under full load . . . runs effortlessly on the straight-away. This means, too, that stress and wear on engine and major power transmission parts is minimized. These operating and maintenance economies—plus the higher trade-in value of Eaton equipped trucks—enable Eaton 2-Speed Axles to more than pay for themselves on trucks of the 1½ ton class and larger. Ask your truck dealer to show you what this means to you.



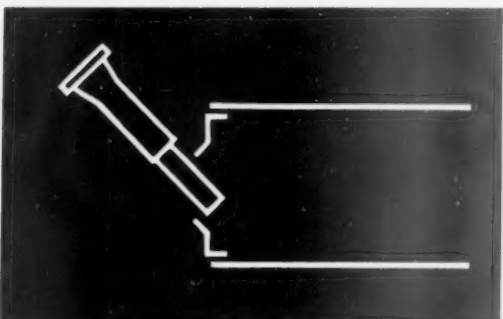
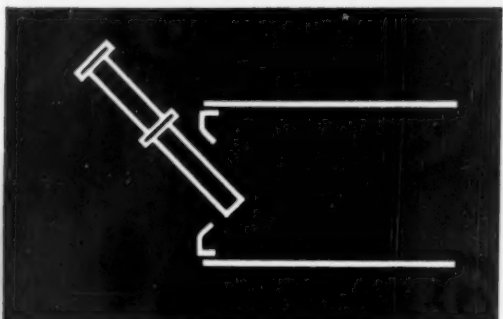
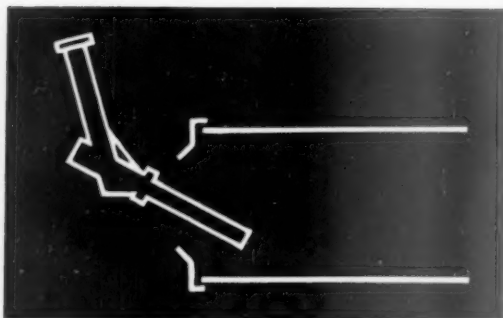
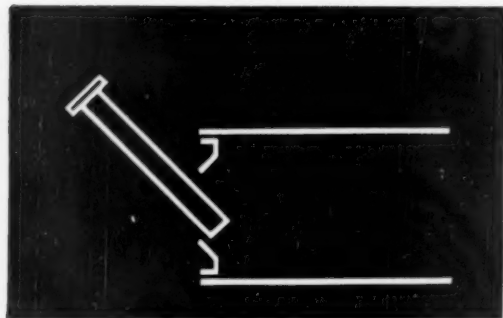
Axle Division

EATON MANUFACTURING COMPANY

CLEVELAND, OHIO



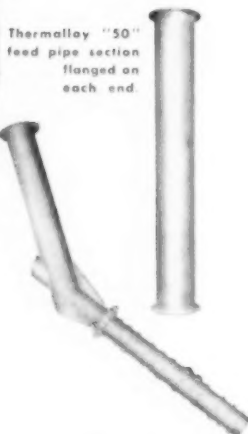
PRODUCTS: SODIUM COOLED, POPPET, AND FREE VALVES • TAPPETS • HYDRAULIC VALVE LIFTERS • VALVE SEAT INSERTS • JET ENGINE PARTS • ROTOR PUMPS • MOTOR TRUCK AXLES • PERMANENT MOLD GRAY IRON CASTINGS • HEATER-DEFROSTER UNITS • SNAP RINGS • SPRINGTITES • SPRING WASHERS • COLD DRAWN STEEL • STAMPINGS • LEAF AND COIL SPRINGS • DYNAMATIC DRIVES, BRAKES, DYNAMOMETERS



THERMALLOY* Feed Ends and Feed Pipes are *EASY TO INSTALL*



Thermalloy "40" kiln
feed end of segmented
cone design.



Thermalloy "50"
feed pipe section
flanged on
each end.

Thermalloy feed pipe
assembly of unique
"angled" design.

The diagrams above show some of the many ways in which Thermalloy feed ends and feed pipes can be adapted to your kiln requirements.

No special "built-up" brick feed ends are necessary, thus reducing installation costs. The segmental design of Thermalloy feed ends prevents cracking due to expansion and contraction. And Thermalloy feed ends have lasted up to *10 times as long* as "bricked-up" ends.

With the many different designs of Thermalloy feed pipes and feed ends available, an Electro-Alloys engineer can help you choose the type best adapted to your requirements—for easiest installation and maximum service life.

Call your nearest Electro-Alloys office, or write Electro-Alloys Division, 2019 Taylor St., Elyria, Ohio.

*Reg. U. S. Pat. Off.

Specify **THERMALLOY®** for heat and abrasion resistance
... **CHEMALLOY®** for corrosion resistance

AMERICAN
Brake Shoe
COMPANY

ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO



Get All-Around Motor Protection with **SAFETY-CIRCLE**

THAT SOLID CAST IRON FRAME protects *Safety-Circle* working parts against physical damage from every angle. The completely enclosed bottom provides extra protection and extra strength. End brackets are drip-proof at no premium.

Because the frame is cast iron, it is resistant to rust and corrosion. It withstands physical abuse and will not distort.

Protected Inside, Too

Safety-Circle protects against internal breakdown with multiple-dipped and baked

stator and die-cast aluminum rotor. *Ball bearings are factory-lubricated and need no attention for years.* Wide open internal construction and large fans keep temperatures well within rated limits.

Don't be satisfied with a motor that gives you less than full protection. Insist on the extra protection of *Safety-Circle*.

For complete details on *Safety-Circle* advantages, see your A-C Authorized Dealer, Sales Office, or write for Bulletin 51B6210B. Sizes from 1 to 20 hp, 326 frames and smaller.

A-3145

Safety-Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS, 975A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Served . . .

by Allis-Chalmers Authorized Dealers,
Certified Service Shops and Sales Offices
throughout the country.



CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



PUMPS — Integral motor and coupled types from 1/2 in. to 72 in. discharge and up.



MECHANICAL RAYMOND AIR SEPARATORS

The Raymond Whizzer type Mechanical Air Separator has proven outstandingly successful in the cement industry for closed circuit grinding classifying both raw mix and cement clinker.

Great flexibility is assured with these units in fineness control. With the proper setting of the grinding mill, the change from standard to high early strength cement can be made externally and while the Separator is running.

In construction, as well as in operation, Raymond Separators are proved in performance. Rugged structural steel framework, high grade bearings, extra sturdy drive mechanism, heavy gauge plates and hardened liners, all help to insure smooth vibrationless operation and long service life.



Built in nine commercial sizes, 2'6" to 18'0" diameter



LABORATORY AIR SEPARATOR

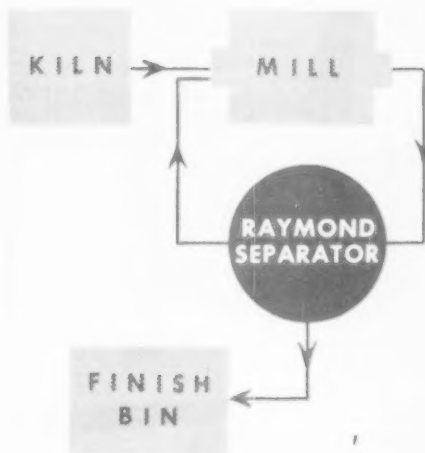
For classifying test samples
Useful in product control.



FOR PRODUCTION OF ALL GRADES of CEMENT

CLOSE-CIRCUIT Your System

with a RAYMOND Mechanical Air Separator



For full details
and performance
records of
Raymond Me-
chanical Air
Separators
write for Cata-
log No. 58.

... and profit by these proved advantages!

Appreciably increased grinding mill capacity.

Close control over the specific surface area of the finished product.

Consistent finished materials at any surface area specification.

Overall economy of Raymond Separators . . . minimum power requirements, and record low maintenance and operating costs.

The wide adaptability of Raymond Mechanical Air Separators makes them equally efficient for many other materials: limestone, gypsum, chemicals and manufactured products.

COMBUSTION ENGINEERING — SUPERHEATER, INC.

RAYMOND PULVERIZER DIVISION

1307 North Branch St., Chicago 22, Illinois

Sales Offices in Principal Cities

Lorain 820

HAS PLENTY

of WHAT IT TAKES for ROCK!

► Got some tough digging? Put a Lorain-820 on the job . . . and watch things happen! Big Lorain-820's in the 2-yd. class, have the stamina to stick with the hardest materials . . . whether you're stripping from the top or gouging out the deepest cuts. From dipper to crawler, the "820" is built for those tough jobs. Check the list of features at the right—and then ask your Thew-Lorain Distributor to point them out to you on an "820" in action.

PORTER BROWN LIMESTONE CO., of Springfield, Tennessee loads trucks at a fast rate with their 2-yd. Lorain-820.



820 HAS PLENTY OF TURNABLE ADVANTAGES

Hydraulic coupling—no engine stall; no machinery shocks; no engine loading * Double center drive pinion which applies power directly; (a) fully concentrated on any one operation or (b) spreads power for high-speed simultaneous operations * Extra wide clutches

820 HAS PLENTY OF CRAWLER FEATURES

Independent crawler travel * Chain drive * Two speeds in either direction * Steers either direction * 4-way ratchet and pawl travel and tread lock * Propelling mechanism runs in oil bath * Wider treads—extra strong, heat-treated drop forgings

820 HAS PLENTY OF SHOVEL FEATURES

Positive chain crowd * All-welded, all-steel, torsion-resisting boom * All-steel dipper stick * Drop forged crowd rack * Power dipper trip—saves time and operator's energy * Automatic crowd brake to hold stick extended

820 HAS PLENTY OF CRANE, DRAG, CLAM FEATURES

Interchangeable to Cranes, Clams or Drags * Simultaneous hoist, swing and travel (or boom derricking) * Worm driven high speed boom hoist * All-purpose Crane Boom head—6 part line * High gantry available (power lowered) * "Cable-Miser" fairlead * Large diameter boom head sheave for Draglines

THE THEW SHOVEL CO., LORAIN, OHIO

THEW **LORAIN**[®]
on CRAWLER or RUBBER



SHOVELS
CRANES
DRAGLINES
CLAMSHELLS
HOES



**"WE GOT MIGHTY TIRED
SITTING UP NIGHTS
WITH SICK BELTING**

**Then we tried the Thermoid treatment!
Now we're sitting pretty!"**



"Here at the Quarry we operate 9 hours a day, 6 days a week. Our conveyor belting on flight No. 1—where the belting really takes a beating from big, jagged, saw-toothed rocks—was giving us plenty of trouble.



"Because of our long work-week, the men began grumbling about having to put in so much extra time late at night repairing rips and tears in this beat-up belting.



"So we called up our belting distributor and he brought a Thermoid engineer around. 'What you need,' said the engineer, 'is Thermoid 'H.T.' belting with a special soft rubber ply that will cushion those rocks like a cradle.'



"That was several months ago. Now, after watching that Thermoid 'H.T.' belting take the most savage pounding imaginable, we know it is a quality product that can be depended on to stand up under plenty of slam-bang punishment.



"If you have a belting problem, Mister, why not get in touch with your Thermoid distributor. Whether your problem is run-of-mill or highly specialized, he'll help you solve it—efficiently and economically."

A Complete Line of Quality Rubber Products For All Industrial Needs

In addition to Conveyor Belting, Thermoid makes Transmission Belting, F.H.P. and Multiple V-Belts, Elevator Belting, and a complete line of Wrapped and Molded Hose, Industrial Brake Linings and Friction Materials.

*It will pay you to
Specify Thermoid!*

**Thermoid
Company**

Main Offices and Factory • Trenton, N. J., U. S. A.
Western Offices and Factory • Nephi, Utah, U. S. A.
Industrial Rubber Products • Friction Materials • Oil Field Products

mirror Magic!



You've got a bit of growin' to do, sonny. It takes lots of skill, training, and experience to be a good fighter, to be a good salesman. Chase Salesmen are thoroughly trained experts in the bag business . . . as it applies to your business. They are supported by more than one hundred years of experience in supplying better bags for American industry and agriculture. Do you want better protection? Do you want improved appearance? Do you want a container that is designed for your specific needs? All these important points add up to increased sales! Check with us today. Your Chase Salesman will promptly contact you . . . and you'll be glad he did!

Bags for all industry and agriculture



CHASE

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- cotton bags of all kinds
- Topmill burlap bags
- paper & Multiwall bags
- Sacklin open mesh bags
- combination bags, liners, and specialties.

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PITTSBURGH • KANSAS CITY • LOS ANGELES • MINNEAPOLIS • GOSHEN, IND. • PHILADELPHIA • NEW ORLEANS • ORLANDO, FLA. • SALT LAKE CITY
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NEW and Heavy-Duty Engineered

TO SAVE YOU MONEY



Whether you haul coal or rock, sand or gravel

You get lower-cost performance, more miles of trouble-free hauling, and longer life from every new International Truck because every new International Truck is **HEAVY-DUTY ENGINEERED**.

Proof of this statement boils down to this:

1. Heavy-duty truck buyers keep records of hauling costs right down to the last penny. On the basis of what these records show, these cost-conscious men have bought more heavy-duty International Trucks than any other make for 18 straight years.
2. The extra values that for almost two decades have assured America's most exacting truck buyers of better performance at lower cost per mile are engineered into every new International Truck from the smallest to the largest.

Every new International Truck from 4,200 to 90,000 pounds gross vehicle weight offers heavy-duty engineered stamina and operating economy combined with new comfort and ease of handling.

You get new comfort and driving ease in the "roomiest cab on the road." Step into the Comfo-Vision Cab

and discover how much more "move-around room" there is in the "roomiest cab on the road." Note how easy it is to adjust the wide seat to just the right position.

Look out through the one-piece, scientifically curved Sweepstake windshield. Place your hands right where they feel natural for driving—and you'll find them gripped around the sturdy steering wheel. And just wait till you start going—you'll enjoy more positive control... thanks to new Super-steering.

You get more all-'round truck value in every new International Truck. See the new valve-in-head truck engines, new rear axles, new features throughout—all proved under actual operating conditions. Get the facts about new Internationals—the world's most complete line of trucks.

See for yourself... see your International Truck Dealer or Branch, soon.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors... Motor Trucks... Industrial Power... Refrigerators and Freezers



ALL NEW, ALL PROVED

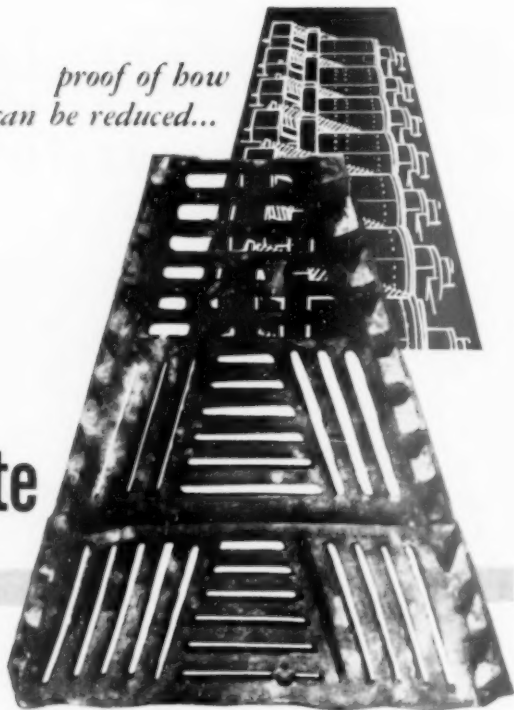
INTERNATIONAL TRUCKS

INTERNATIONAL HARVESTER COMPANY CHICAGO

ROCK PRODUCTS, October, 1950

*proof of how
milling costs can be reduced...*

this
AMSCO Grate
has milled
193,797 tons



**An actual example of how AMSCO Grates last longer,
reduce shutdowns and increase milling profits.**

Equally Big Savings On Liners, Too!
Recent production figures on Amsco double-wave Liners in a mill grinding copper ore: 667,508 tons ground . . . at a liner cost of about a half-cent per ton! *It will pay you to investigate the long, low-cost service of Amsco Liners!*

Find out more
about Amsco
Liners and
Grates



Be sure to ask for a copy of Bulletin 449-ML. Describes the characteristics of Amsco ball mill alloys; gives additional facts on dollar-saving installations. Free copy on request.

Here's an actual photograph that proves an important, profit-building point to users of ball mill equipment . . . *the real cost of liners and grates is the actual service cost.*

This Amsco grate has milled 193,797 tons . . . compared with just 113,000 tons for a previously used hardened steel grate which ran under identical conditions. And, during this period of 72% greater tonnage milled, *the Amsco grate required no down-time for repair.* The previously used grate started to crack at 50,000 tons—required many shutdowns for plugging holes.

Because of heavy impact, this particular Amsco Grate was made of austenitic chromium-manganese steel—one of three Amsco alloys developed for specific conditions of impact and/or abrasion. These Amsco liner and grate alloys can result in big savings on milling costs. Amsco Engineers are fully qualified to make alloy recommendations based on your operating conditions—*write today for the name of the Amsco engineer nearest you.*

AMERICAN

Brake Shoe

COMPANY

AMERICAN MANGANESE STEEL DIVISION

377 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. in Canada: Joliette Steel Division, Joliette, Que.

Better Fragmentation Less Vibration...No Back Break

**DU PONT BLASTING PLAN ALSO INCREASES SAFETY
AND PROMOTES ECONOMY IN ARKANSAS QUARRY**



THE DU PONT QUARRY BLASTING PLAN was used at the Minnesota Mining and Manufacturing Company's Little Rock Quarry to produce better fragmentation with maximum safety. Here charges consisted of Du Pont "Nitramon" A—the safest blasting agent known—and a combination of "Nitramon" Primer and Primacord, detonated by electric blasting caps.



LOADING WAS EASY. For in addition to its safety features, "Nitramon" A is non-headache producing. Nine well drill holes, averaging 86 feet in depth, were loaded with "Nitramon" A. Holes were spaced 25 feet apart, 20 feet back from the face. Circuit wires were attached to a Du Pont Blasting Timer set for intervals of .015 second between holes. The shot was fired by remote switch.



RESULTS WERE EXCELLENT. The shot brought down 32,000 tons of rock with no back break. Rock was well broken up, and vibration was greatly reduced. These characteristics have proved the economy of the Du Pont Blasting Plan in many types of quarries—notably shale, limestone, granite, cement and trap rock.

DU PONT EXPLOSIVES



Blasting Supplies and Accessories

Ask your Du Pont Explosives representative for complete information about this better blasting plan today.
E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept.,
Wilmington 98, Delaware.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

airalon

the ready-to-use

air entraining agent...

and plasticizer

for intergrinding

Portland Masonry Cement



airalon

is a highly effective mixture of resin acids and fatty acids that is ready to use as received. It contains, in one easy-to-handle compound, the necessary ingredients to make a high quality masonry cement.

airalon extends the plasticity of masonry cement, makes it "fatter", more buttery. At normal air contents, Airalon improves water-retention and workability-retention. At lower than normal air contents, Airalon maintains present quality standards, with increased strengths when hardened.

airalon is economical to use. It enables the cement maker to produce his present quality masonry cement at lower cost... or to produce a higher quality masonry cement at no increase in cost. Because Airalon is added at the cement mill as received, in liquid form, it simplifies problems of inventory, handling, and storage. And because Airalon is a good grinding aid, it eliminates the expense of one.

airalon has been exhaustively tested in our own laboratories and in large commercial grinds... has the approval of ASTM under Cement Specification No. C175.

Dewey and Almy Chemical Company

CAMBRIDGE 40, MASS.
CHICAGO 38
MONTREAL 32

AIRALON T.M. OF D.E.A.C.C.

Be Multiwall Wise

Acclimatize

Keep Bags From Getting Thirsty



Multiwall Paper Shipping Sacks are amazingly tough. They don't need to be pampered. But they *do* need reasonable care. Unless they're protected against moisture loss, they dry out and can't work their best when being packed, closed, or handled. In some sections of the country "drying out" may happen in winter, in other sections during the summer, depending on the humidity. But it's a simple matter to keep Multiwalls from getting thirsty. Bemis Multiwall Specialists show you how.

Bemis



"America's No. 1
Bag Maker"

PEORIA, ILL. • EAST PEPPERELL, MASS. • SAN FRANCISCO, CALIF. • WILMINGTON, CALIF.
MOBILE, ALA. • VANCOUVER, WASH. • HOUSTON, TEXAS

Baltimore • Boise • Boston • Brooklyn • Buffalo • Charlotte • Chicago • Cleveland • Denver • Detroit
Indianapolis • Jacksonville, Fla. • Kansas City • Los Angeles • Louisville • Memphis • Minneapolis
New Orleans • New York City • Norfolk • Oklahoma City • Omaha • Phoenix • Pittsburgh • St. Louis
Salina • Salt Lake City • Seattle • Wichita

MAIL THIS COUPON TODAY!

BEMIS BRO. BAG CO., 408 M Pine St., St. Louis 2, Mo.

- ☐ Have Multiwall Specialist give information on care of bags.
☐ Send information on Multiwall specifications

Name

Company

Address

City Zone State

Horizontal drag conveyor, employing a single strand of Link-Belt class H-480 chain, of PROMAL, operating 50 ft. per minute, handles 150 tons of ground limestone per hour.



The photo-micrograph below (100 times actual size), clearly shows the tough network structure which gives PROMAL its great strength and resistance to wear.



IT'S WEAR THAT MAKES

THE MONEY GO

LINK-BELT PROMAL CHAINS Resist Wear Longer

Strength, toughness and resistance to abrasion are characteristics of PROMAL, the stronger, longer wearing metal, that make it especially useful in chains and buckets. Where severe service conditions are to be met, PROMAL is the preferred metal. It may be repeatedly heated and cooled without damage or growth and may therefore be used in moderately high temperature applications.

PROMAL, an original Link-Belt development, has a uniform structure throughout its cross section, and its resistance to wear and abrasion continues after the surface is worn off. This resistance to wear is due to its own peculiar structure, and not to its Brinell hardness.

10-274

Class C combination chain is available with cast center links of PROMAL, and side bars of high carbon steel.

Class GL and MR roller chains, with cast or steel rollers, are primarily used for conveyors or inclined elevators where load is carried directly by the chain and where reduced chain pull is desirable.

Class 800 Ley bushed chain, of PROMAL for heavy duty service in presence of abrasive material.

Style AA bucket of PROMAL, with heavy reinforced front edge and corners which increase the life of the bucket in handling abrasive materials.

Link-Belt "Flint-Gum" cast sprockets resist abrasion and outlast grey iron several times. Cast steel sprockets are also furnished where service is extra severe.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 3, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg.

Offices, Factory Branch Stores and Distributors in Principal Cities.

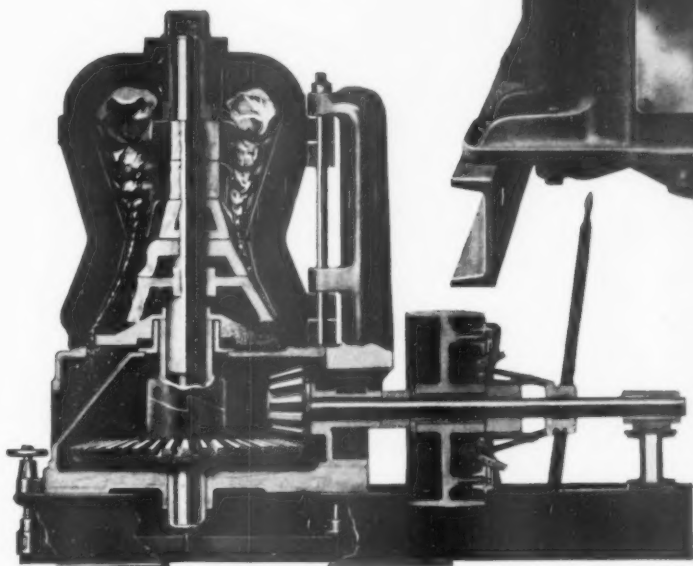
LINK-BELT

Chains and Sprockets



STURTEVANT ROTARY FINE CRUSHERS

**Crush or
Granulate
to Fine, Even
Sizes without
Excess Dust...**



Cross section view illustrating the crushing action

These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine . . . crush fast and do not clog. Available in output capacities from 1 to 30 tons-per-hour. Write for catalog.

STURTEVANT MILL COMPANY

100-A CLAYTON STREET, BOSTON 24, MASSACHUSETTS

Designers and Manufacturers of CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

CLIP AND MAIL COUPON TODAY

Sturtevant Mill Company
102-A Clayton Street
Dorchester, Massachusetts
Gentlemen:
Please send me catalog describing
your Rotary Fine Crushers. I am inter-
ested in crushing _____
Name _____
Street _____
City & State _____
Firm _____

under bid at a profit!

with these 3 way Gardner-Denver advantages

- More work from every crew—every shift
- A steady pace when the going gets tough
- Less "time out" for maintenance



PORTABLE COMPRESSORS—Two-stage, water-cooled—deliver top air capacity regardless of high elevation, desert heat or sub-zero weather. Sizes from 105 to 500 cu. ft.



DRILLS
High hole-clearing ability for faster drilling—powerful rotation saves stuck steel and tight holes—easy riding—a size and weight for every rock.

JACKHAMMERS
Safety tools, gives extra protection—reduced recoil and shorter length means less fatigue—three sizes for fast demolition or heavy-duty work.

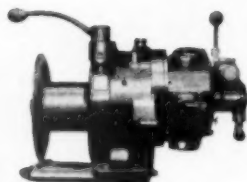
CHISELS AND POINTS
Makes fast time in clay or hardpan—works, too, for chipping, cutting or light demolition—equipped with "D" handle or "T" extension handle.



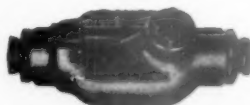
VACUUM BLOWERS—Removable jet with hole spacing—positive, effortless blowing and easily fold machine for steady settings, faster drilling—three sizes.



BACKFILL TAMPER—Well-balanced for easy handling—ruggedly designed—seldom requires maintenance.



AIR HOISTS—Smooth, flexible hoisting power assures accurate load spotting—for 1250 to 3000 pounds rope pull.



1012 LINE OILER—Completely automatic—shuts off air when empty—protects your valuable air tools against "dry runs."

Write for descriptive bulletins.

GARDNER-DENVER Since 1859

Gardner Denver Company, Quincy, Illinois.
In Canada: Gardner Denver Company (Canada), Ltd., Toronto, Ontario.

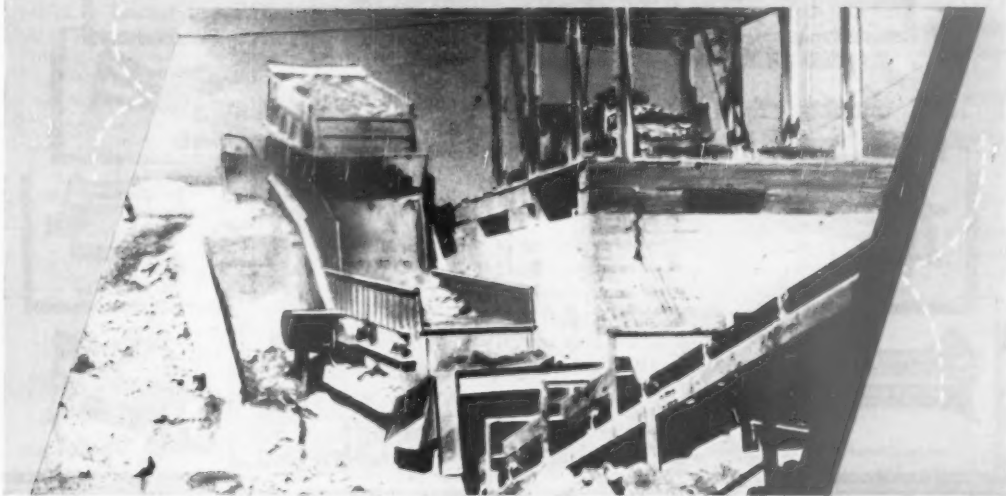


**RIP-
RAP
IS
TOUGH**

SIMPLICITY IS TOUGHER!

No matter how hard a material you have to handle, it will meet its match in a SIMPLICITY Heavy Duty Scalper. Below is shown a SIMPLICITY 5 x 12 Model DR scalper at the Thompson Crushed Rock Co., Kansas City, Mo. Built to ignore punishment, this SIMPLICITY scalper takes a terrific pounding from the constant stream of trucks dumping directly on the scalper deck! While scalping off volume tonnage of rip-rap, with the aggregate screened onto a conveyor, this SIMPLICITY operates with minimum maintenance and servicing.

SIMPLICITY Heavy Duty Scalpers are in profitable operation throughout the country, handling a variety of aggregates. To indicate its versatility, in one plant, the SIMPLICITY scalper is equipped with 6" and 2" openings, so that around 500 tons per day of rip-rap is scalped off while the remainder of the stone goes through the crusher. In another installation, SIMPLICITY 5' x 10' scalping screens are operated 160 hours per week handling, in that time, 144,000 tons of material! Call in a SIMPLICITY sales engineer, there is no obligation. Perhaps he can suggest a SIMPLICITY shortcut to more production and more profits for you.

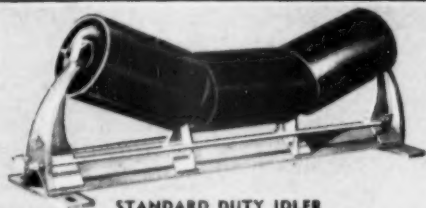


SALES REPRESENTATIVES IN ALL PARTS OF
THE U. S. A. • FOR CANADA: CANADIAN
BRIDGE ENGINEERING CO., LTD., WALKER-
VILLE, ONTARIO • FOR EXPORT: BROWN &
SITES, 50 CHURCH ST., NEW YORK 7

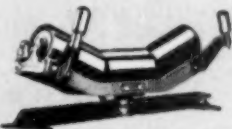


SIMPLICITY ENGINEERING COMPANY • DURAND, MICHIGAN

THERE'S A *Continental* IDLER for every purpose



STANDARD DUTY IDLER



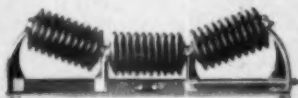
SELF-ALIGNING TROUGHING IDLER



SELF-ALIGNING RETURN IDLER



FLAT ROLL



RUBBER DISC IMPACT IDLER



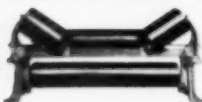
SELF-ALIGNING FLAT BELT IDLER



FLAT BELT IDLER



GRAIN FLAT BELT IDLER



GRAIN CONCENTRATOR IDLER

Belt conveyors are used for handling many types of material. For this reason, Continental manufactures a variety of Idlers, each designed to best take care of a particular application.

When ordering your next Belt Conveyor, specify Continental Idlers and take advantage of our complete line.

Most standard size Idlers can be shipped FROM STOCK. Other sizes can be shipped promptly.

Specify **CONTINENTAL**

C.O. 4804



HEAVY DUTY IDLER



PICKING TABLE IDLER



UNIT STAND IDLER

**INDUSTRIAL DIVISION
CONTINENTAL GIN COMPANY**

BIRMINGHAM, ALABAMA

ENGINEERS



ATLANTA • DALLAS • MEMPHIS • NEW YORK



MANUFACTURERS

Now... the Most Versatile Loader on Wheels!



Here's the most versatile, practical loader ever developed for wheel tractors. It can dig in front . . . dump in front like the conventional loader. BUT, it can also dig in *back* and load in *front*.

You can dig in back . . . move straight forward to the truck . . . the bucket swings *straight over* the roof . . . and the load is dumped into the truck. Thus you eliminate the turning necessary with ordinary front end loaders . . . eliminate *half* the gear shifts and *half* the clutch wear. You save time and fuel . . . cut operator fatigue. You speed loader operations . . . can load at better than a yard a minute.

You get far greater traction and almost effortless steering with the Strait-Line. Rear-carried bucket load adds needed weight to the rear driving wheels . . . subtracts weight from the front steering wheels. Increased traction plus the new PUSH-TILT bucket with extended loading lips, enables you to get bigger bucket loads. Two levers control all operations.

Add them all up . . . ability to select your type of digging, front or back as the job requires . . . Strait-Line operation with back digging which gives you faster operation, greater traction and easy steering . . . fuller buckets . . . and you'll see where your operations can profit with the Strait-Line. For information and literature, see your Oliver Industrial Distributor or write direct to The OLIVER Corporation, 19300 Euclid Avenue, Cleveland 17, Ohio.

THE OLIVER CORPORATION

A complete line of industrial wheel and crawler tractors

"FINEST IN INDUSTRIAL MACHINERY"



Conventional front digging, primarily used with Strait-Line where unit digs and moves straight ahead to load.

Back digging. Note how extended loading lips easily penetrate the bank.

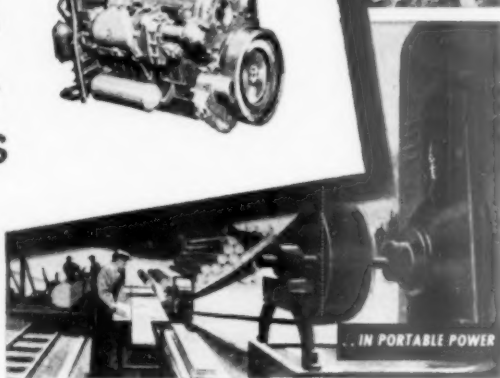
PUSH-TILT action which lifts cutting edge 20° and thrusts it into bank.

Carrying position—bucket is tilted to retain load and is carried low enough to increase both traction and stability.

Dumping position. Bucket has been carried over the roof and dumps in front.



The Sign
of
Extra Service



This is the Diesel

that gave power
users new ideas

SHOW an engineer a better source of power and things start happening fast.

That's illustrated by events since General Motors first introduced the "71" Series of two-, three-, four- and six-cylinder Diesel engines, ranging from 50 to 200 horsepower—little brothers of the famed two-cycle GM Diesels that drive so many crack American passenger and freight trains.

Bus engineers went for the "71" at first sight. They liked its compactness, its fuel economy, its clean-burning operation. Now more than 20,000 city and inter-city buses are powered by GM "71" Diesel engines.

Army and Navy engineers approved its rugged strength and dependability. During the war they used 182,000 GM "71" Diesels to operate landing craft, tanks, tractors, bulldozers and other military vehicles.

So, too, have designers of all types of power-driven equipment turned to the GM "71" for low-cost efficient power. Today they are using it in heavy-duty trucks, tractors and earth movers, in work and pleasure boats, in cotton gins, lumber mills, oil rigs and for many other mobile, portable and stationary uses—with remarkably successful results!

That is because the GM "71" is a two-cycle engine that delivers power on every piston downstroke—in contrast to most Diesels that deliver power only on every second downstroke. This makes GM Series 71 Diesels more compact, lighter, faster-accelerating, smoother, cleaner-burning—and twelve years' experience in applications totaling over 46,000,000 horsepower proves it!

The GM "71" gives you Diesel brawn without the bulk. It is Diesel power at its best.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES ... Up to 275 H. P. DETROIT 28, MICHIGAN MULTIPLE UNITS ... Up to 800 H. P.

GENERAL MOTORS

*Only GM Diesels provide
all these advantages*

Smaller size, less weight per horsepower • Two-cycle smoothness, power on every downstroke • Quick starting, on its own fuel • Unit injectors—no high-pressure fuel lines • Rapid acceleration • Cleaner burning • Better high-altitude performance • Easy accessibility



"Your Key to Power Economy"

ALL ROPES look ALIKE... but



TESTING GOES

100 times beyond normal vision

Precision polishing and high powered magnification enable us to go 100 times beyond normal vision in examining Wickwire Rope steel for classification of grain size to McQuaid-Ehn* standards.

Uniformity of grain size in steel assures longer life and greater reliability in Wickwire Rope.

Right down the line...starting with the melting and refining of our steel...and continuing through heat treating processes and cold drawing of the wire, we maintain complete control over the grain size of steel used in Wickwire Rope.

This quality control of basic properties is possible only with a company whose operations are fully integrated from the actual making of the steel to the stranding of the finished rope. It's just one more example of how Wickwire goes "beyond specifications" to give you—at market prices—wire rope that is unsurpassed for reliability, safety and longer life.

See your local Wickwire distributor for the right rope for your particular requirements. Wickwire Rope is available in all sizes and constructions, both regular lay and WISSCOLAY Preformed.

*For detailed information on the McQuaid-Ehn test and what it means to you in superior rope performance, write to Wire Rope Sales Office, Wickwire Spencer Steel Division of C. F. & I., Palmer, Mass.

WICKWIRE ROPE



A PRODUCT OF THE WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

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PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

ROCK PRODUCTS, October, 1950

FREE



From Western Precipitation—the organization that pioneered the commercial application of Cottrell Precipitation...

IF YOU ARE ENGAGED in any phase of industry where the recovery of dusts, fumes, fly ash, mists, fogs or other suspensions from gases is a problem, you will find this booklet on the COTTRELL Electrical Precipitator helpful and informative.

Western Precipitation pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 42 years Western Precipitation has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C 103.

28 PAGES
of helpful facts to
know about
COTTRELL
ELECTRICAL
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Packed with helpful COTTRELL Information!

This Western Precipitation Cottrell booklet is designed to answer questions of design engineers, plant engineers and others interested in applying Precipitators to the recovery of industrial dusts and mists. It discusses such subjects as...

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- Principal parts of a Cottrell Precipitator.
- Mechanical and Electronic Rectifiers.
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- Removal of Collected Material.
- Factors in Shell Construction (steel, concrete, brick, etc.).
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... and many other basic Cottrell facts. Write for your free copy of Bulletin C103 today while supplies are adequate!

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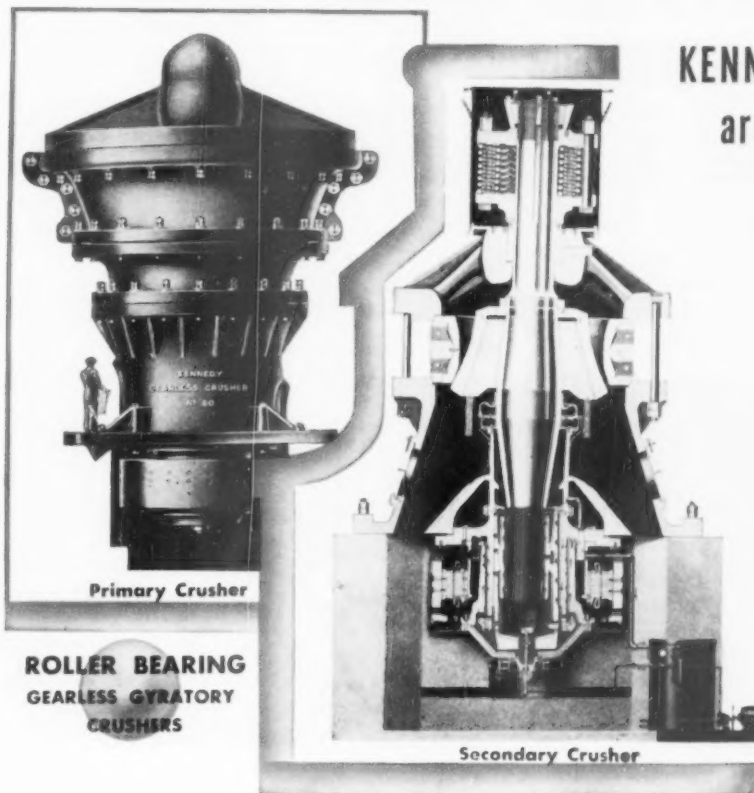
Western Precipitation is not affiliated with any other company in the field of electrical precipitation except its wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. Whether you are now contemplating the installation of a Cottrell Electrical Precipitator, or may be interested in such an installation at a future date, we can and will serve you in any part of the United States or other countries.

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ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR
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KENNEDY CRUSHERS
are really

Rugged!

*Synchronous motor
built into pulley
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*Power applied ONLY
for crushing*

*Force-feed
lubrication*

*No gears to
waste power*

*Added power at
no added cost*

*Quiet — smooth
Frictionless action*

*Varying capacities
to serve every
purpose*

Designed and built to produce, economically and consistently, maximum loads of uniform products. Assures efficient service with minimum "time off for repairs" under the most severe operating conditions.

Costs less in the long run because it has a larger capacity; uses less power; holds repair bills to a

minimum; produces more and better rock tonnage, faster and at lower cost.

Kennedy Crushers are made in various size units delivering from 12 to 3600 tons per hour. Engineered to serve your exact needs. Fifty years experience in the building of heavy duty crushers is your assurance that "It Costs Less To Own The Best" when you use KVS equipment.

Send for bulletins describing, fully, all types of KVS crushers

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TWO PARK AVENUE, NEW YORK 16, N. Y. FACTORY: DANVILLE, PA.

BAY CITY - the biggest value in $\frac{3}{4}$ yard machines ... easily **convertible**

Quick convertibility without machinery change is a feature that gives you more for your equipment dollar when you buy BAY CITY. Then too, you get ruggedness, dependability and long life that can't be matched.

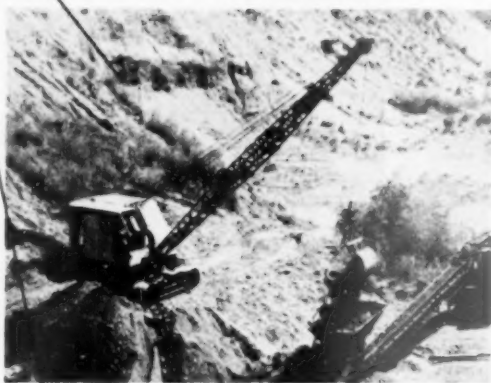
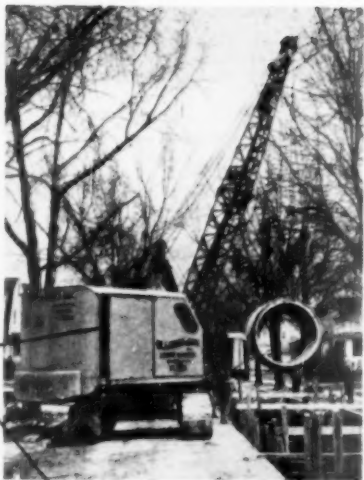
Well balanced for Crane Work.

Stability for low boom operations.

Easy operation for hard digging.

High line speeds for faster material handling.

Power for fast digging cycle.



BAY CITY

BAY CITY SHOVELS, INC., BAY CITY, MICHIGAN



SHOVELS • CRANES • HOES • DRAGLINES • CLAMSHELLS

Your Union Multiwall Specialist

knows how to make your package do a selling job



UNION package designers can transform the fine printing surface of a Multiwall Bag into a compelling advertisement for your product at the point of sale—where advertising really pays off! Your brand name and trademark, exclusive features, formulations and instructions for use—all can be presented with color and drama to help make your product sell.

That Union package designing really sells has been proved year after year in the sales records of

many companies—and repeatedly proved in national packaging competition.

This packaging experience is yours to command, through your Union Multiwall representative. Use it!

★ ★ ★

SPECIAL NOTE TO USERS OF OTHER TYPES OF PACKAGING

Companies making over 300 different products have cut packaging and handling costs by switching to Union Multiwall Bags.

When your Union Multiwall representative calls let him analyze your entire packaging problem to see what savings you can effect!



Multiple Protection



Opens Easily



Prevents Siftage



Empties Clean



UNION Multiwall Bags

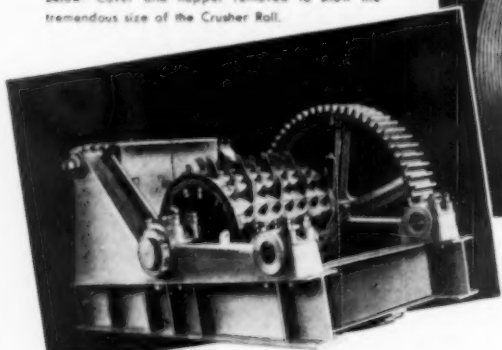
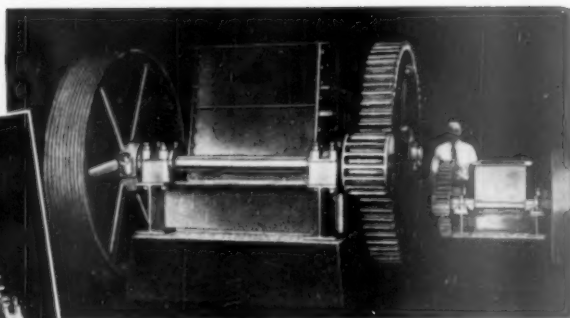
UNION BAG & PAPER CORPORATION

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Offices in: CHICAGO, ILL. • NEW ORLEANS, LA. • MINNEAPOLIS, MINN. • KANSAS CITY, MO. • HOUSTON, TEXAS

Right: McLanahan designs and builds Crushers for every size operation and for any material.

Below: Cover and hopper removed to show the tremendous size of the Crusher Roll.



McLANAHAN

Crushers

Large enough
for any
Operation

- Single and Double Roll Crushers (Primary and Secondary)

- Heavy Duty Rock Crushers — Automatic Steelstrut Toggle, Quick Adjustment and Pioneer series

- Double Roll Fabricated Steel Crushers

- Jaw Crushers

- Portable and Semi-Portable Crushing Plants

- Dry Pans Super Heavy Duty

- Conveyors

- Dryers of Revolving Type

- Elevators

- Feeders

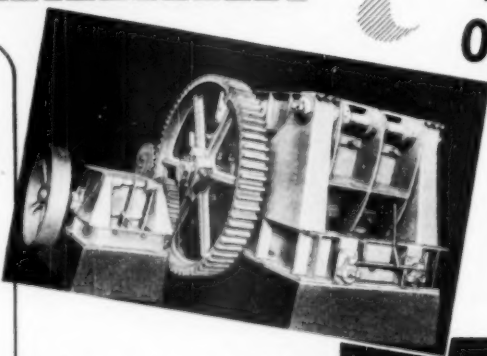
- Hoists

- Ore Jigs

- Screens

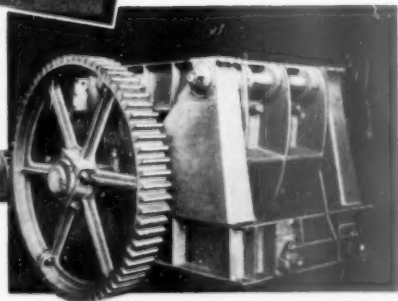
- Washers & Scrubbers

- Special Machinery and Complete Plants



Two other views of a giant Rockmaster Crusher recently shipped from the McLanahan plant.

Here is a specially built Crusher designed for an underground operation, so large that it had to be cut apart and taken down into the pit and then welded together. Typical of the engineering and fabricating ability available at McLanahan to solve your toughest crushing problem.



Headquarters for Pit, Mine and Quarry Modernization

McLANAHAN and STONE Corp.

HOLLIDAYSBURG, PA.

Since 1835

GREAT NEW ADVANTAGES IN TRUCK MIXERS

**achieved with Chrysler Industrial Engines
and Chrysler *gyrol* Fluid Drive**

Reverse rotation of the drum without throwing damaging shocks and impacts into the transmission, engine and other parts of the machine!

No shear pins to replace! Smoother operation! Lower maintenance costs! Longer life! These are only a few of the advantages Chrysler Industrial Engines with gyrol Fluid Drive have brought to operation of truck mixers.

In addition, Chrysler Fluid Coupling prevents engine stalling, reduces clutch wear, eliminates jolts and gear rattle, simplifies starting from standstill with excessive load, gives gradual oil-smooth acceleration—opens a whole new field of improved operation for gasoline-powered equipment. See your Chrysler Industrial Engine Dealer or write us. *Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.*

**Chrysler gyrol Fluid Drive Now Available
For Truck Mixers From These Manufacturers**

Blaw-Knox Division
of Blaw-Knox Company
Chain Belt Company

Jaeger Machine
Company
T. L. Smith Company

Chrysler gyrol Fluid Drive is built integral with Chrysler Industrial Engines. Its cost is only a few dollars more than the conventional flywheel which it replaces.

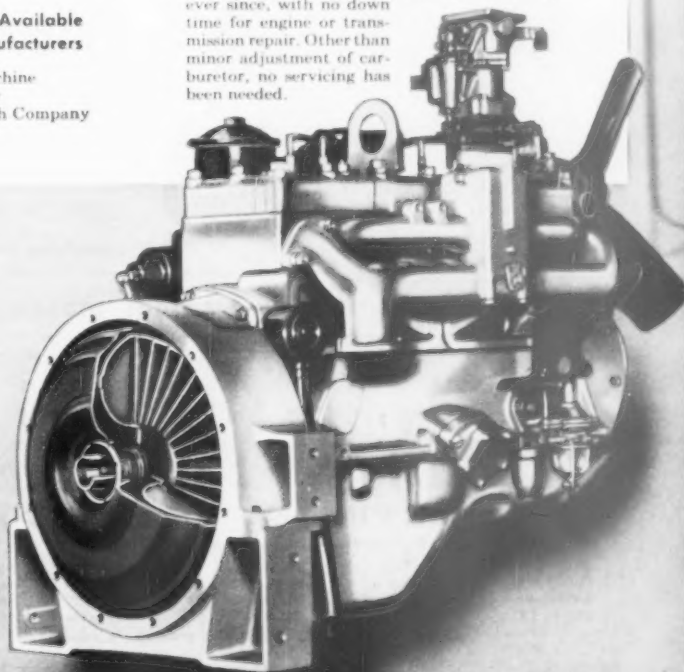
CHRYSLER
**Industrial Engines
and Power Units**

HORSEPOWER  WITH A PEDIGREE



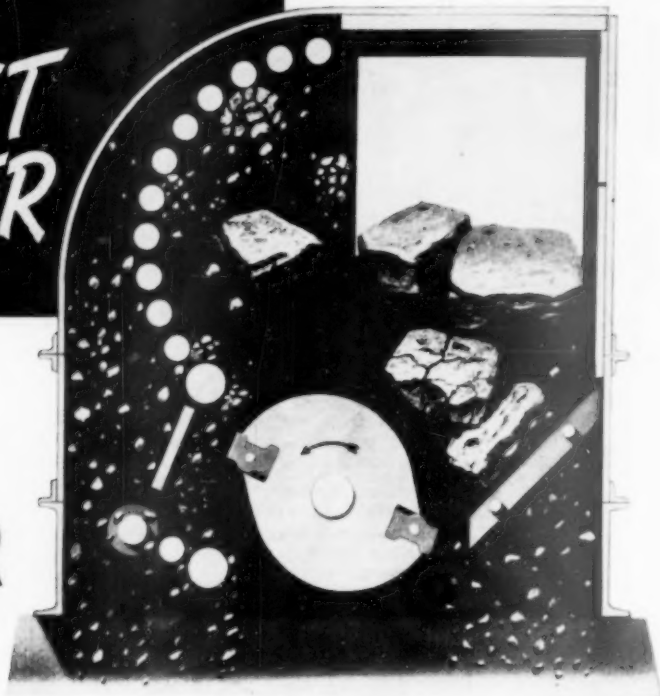
A Typical Experience

Five years ago, a Rex Moto-Mixer equipped with Chrysler Industrial Engine and gyrol Fluid Drive was placed in operation by the Tews Lime and Cement Company of Milwaukee. The unit has been operated continuously ever since, with no down time for engine or transmission repair. Other than minor adjustment of carburetor, no servicing has been needed.



NEW IMPACT CRUSHER

The ROCK BUSTER



Cross-section view tells the story. This NEW Jeffrey Impact Crusher reduces material while in suspension by means of high-speed, 2-ton Rotor, perfectly balanced. Full width stationary and reversible Hammers of heavy cast Manganese steel. Capacity from 60 to 250 tons per hour.

Material fed into side (see photo left) onto a sloping grizzly of desired spacing, which by-passes fines and directs over-size into path of rotor. Cubicle product ranging from 1" to 4" in one pass. Finer sizing possible. Breaker bars adjustable. 30" x 30" opening only restriction to size of feed.

Send for Bulletin No. 827 which goes into detail . . . gives typical screen analysis on 12" limestone. Write today.



Type 303 for reducing hard, friable materials

THE JEFFREY

MANUFACTURING COMPANY Established 1877

939 North Fourth St., Columbus 16, Ohio

Baltimore 2
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Buffalo 2
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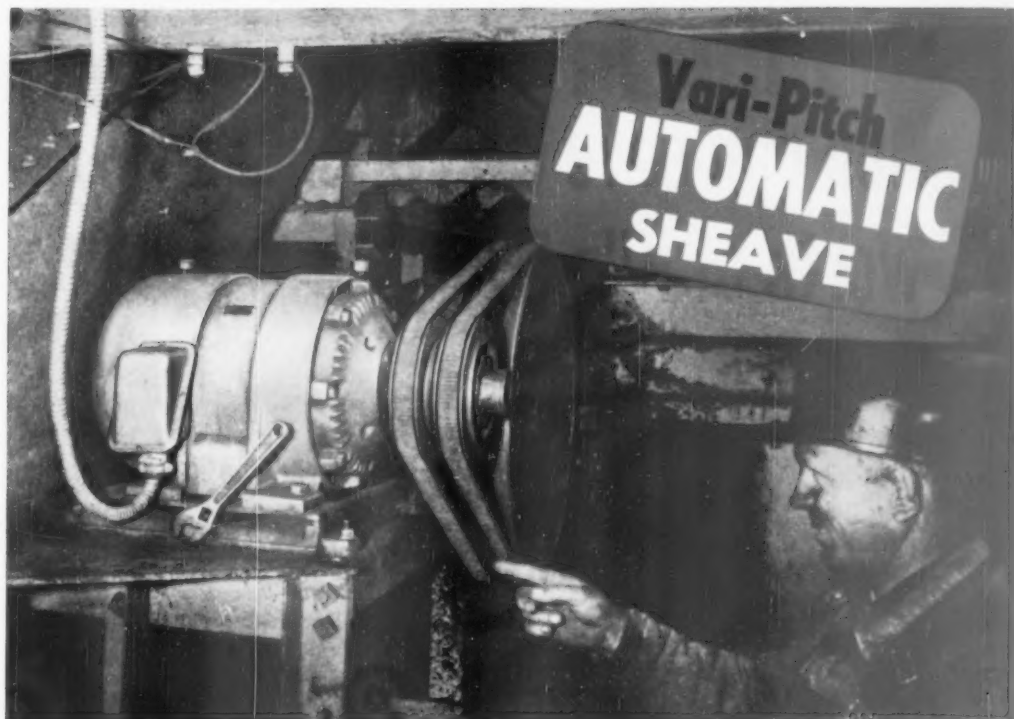
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Complete Line of
Material Handling,
Processing and
Mining Equipment





Best Buy in Variable Speed!

COMPARE THESE FEATURES of *Vari-Pitch* Automatic sheave with any other variable speed drive and see why *Vari-Pitch* Automatic drive gives you more for your drive dollar.

1. Changes speeds with one hand while machine is running.
2. All mechanism is inside one sheave actuated by movement of the motor base.
3. Ample capacity and safety factor of multiple belts.
4. Full range of sizes from 1 to 40 hp.
5. Top speed is 100% higher than low speed.
6. Quiet operation.

7. Cushioned start.
8. Simple design and easy installation make cost low.
9. Occupies no more space than ordinary sheave.

Vari-Pitch Automatic drive will pay for itself very quickly in increased production, improved quality and more flexible operation on many machines in your plant. Ask your Allis-Chalmers Authorized Dealer or Sales Office representative to give you savings and cost figures on your operations. Or write for bulletin 20B7223.

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Vari-Pitch and *Tecrope* are Allis-Chalmers trademarks.

A-3064

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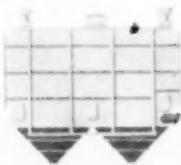
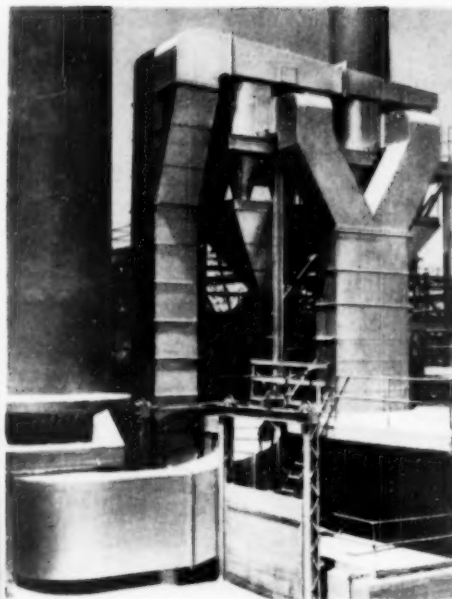
MOTORS — $\frac{1}{2}$ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters, push button stations and components for complete control systems.



PUMPS — Integral motor and coupled types from $\frac{1}{2}$ in. to 72 in. discharge and up.

You can save every dollar's worth of Kiln Dust



BUELL 'SF' Electric Precipitator

Kiln Dust Recovery may call for a Precipitator System, or one that combines both Cyclone and Precipitator. The Buell 'SF' reflects Buell's "Engineered Efficiency" in the collection and recovery of fine dusts, fumes and vapors.

Buell recovers more dust!

Returned dust needs no Pre-Processing!

BUELL RECOVERS MORE DUST—LESS ALKALIS!

High cyclone efficiency — assured by Buell's exclusive van Tongeren "Shave-Off"—boosts kiln dust recovery by tons. Harmless alkali passes through the collector. More "pure" dust is returned. No additional operation for alkali removal. The time and money Buell saves is quickly calculable!

BUELL CYCLONES CAN'T CLOG!

The secret is in the cyclone diameters. They are large! Can't clog! Not even at the outlets. The result? All cyclones in a Buell System operate with uniformly high efficiency—without interruption!

BUELL SYSTEMS SHOW NO WEAR!

Even after 12 years, Buell Systems recovering dust from pulverizers, kilns and driers, still operate with practically no maintenance. Responsible for this record are large-diameter cyclones, made possible by Buell design, that cut the abrasive effect of rock dust to the minimum. Down to zero go shutdown and repairs!

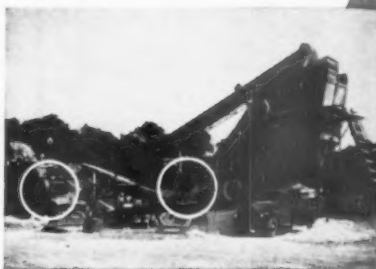
Our engineers will gladly consult with you on your dust recovery problems. Write today to: Buell Engineering Company, 70 Pine Street, Suite 5085, New York 5, N. Y. No obligation, of course.

buell

Engineered Efficiency in Dust Recovery

There's **EXTRA** PRODUCTION

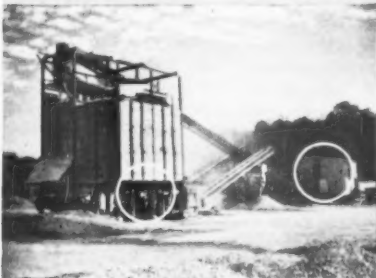
at **8** points in these four plants



SEMI-PORTABLE PLANT, producing agricultural limestone and road rock.



STATIONARY PLANT, producing agricultural limestone and several sizes of crushed rock.



STATIONARY PLANT, producing concrete aggregate, road rock and agricultural limestone.

PORTABLE PLANT, crushing creek gravel for road surfacing. ➔



8

A-W JAW CRUSHERS
of various sizes

each with the

SPEED

**LONG
JAWS**

**LONG
STROKE**

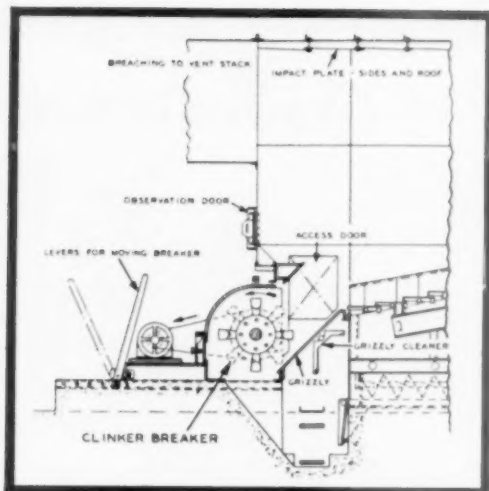
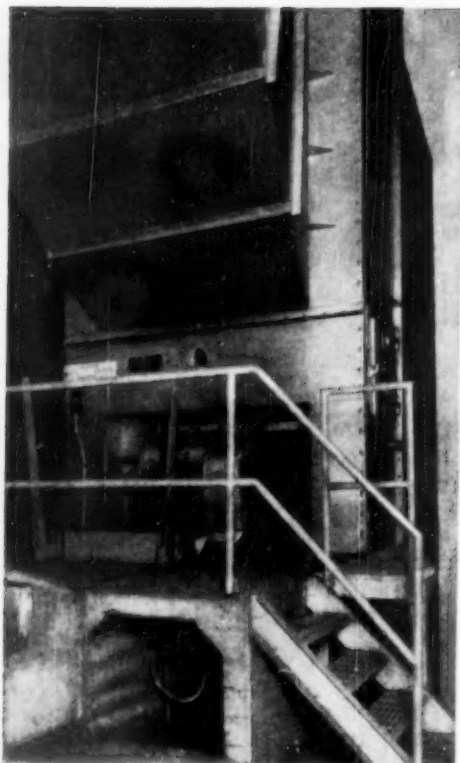


which puts an **EXTRA** amount of
rock through a jaw crusher

Continuous operation and minimum maintenance expense are assured by the skilled engineering and sound manufacturing that characterizes every Austin-Western Crushing and Screening Plant. Each plant is designed to solve a particular production problem. We would welcome the opportunity to discuss yours.

AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U.S.A.

BUILDERS OF **Austin Western**
SINCE 1929



ON GUARD

DAY and NIGHT

That's how a Fuller Clinker Breaker will work for you . . . eliminates the human element. It stands constantly on guard to reduce every oversize (above 1½ inch) piece of clinker, coating, or ring material which will not drop through the grizzly of a Fuller Inclined-Grate Cooler.

The larger pieces slide down over the bars of the grizzly into the path of constantly moving swing hammers, which shatter the oversize pieces, throwing most of the fragments back into the cooler, where further cooling can take place. Hammer wear is at a minimum, because the breaking is done by impact, not by attrition.

Because all the clinker discharged from the cooler is in sizes less than that of the grizzly openings, it eliminates the necessity of removing large pieces by hand, in order to "unchoke" the discharge grates. This can well eliminate costly labor charges with kilns which are prone to periodic dropping of "rings", or carry mixes which "ball" easily in the burning zone.

In addition to reducing the need for close attendance, on the part of the operating force as to the state of the grizzly, clinker

of a uniform top size shows several advantages in later stages of the process, viz:

- (1) Choke-ups, due to accumulations of oversize pieces in chutes and spouts of the conveying system, do not occur.
- (2) Irregular proportioning of mill feed, due to oversize pieces hanging up in the feed openings, is eliminated.
- (3) Breaking of elevator buckets, due to jamming on oversize pieces in the close clearances of elevator boots, can be forgotten.
- (4) Segregation in storage or surge bins, due to varying clinker sizing, is reduced.
- (5) Clinker suitably sized for preliminary grinding is assured.

Application of the Fuller Clinker Breaker can be made to existing Fuller Coolers with no major changes to the cooler.

The photograph above shows a Fuller Clinker Breaker applied to a Fuller Cooler in a cement plant in the southwest. Four coolers are so equipped.

If you are interested, write for Bulletin CB-1, illustrating and describing the Fuller Clinker Breaker. We will gladly send you a copy.

fuller
 DRY MATERIAL CONVEYING SYSTEMS
 AND COOLERS — COMPRESSORS AND VACUUM PUMPS —
 FEEDERS, AND ASSOCIATED EQUIPMENT

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 120 S. LaSalle St., Chicago 3
 420 Chancery Bldg., San Francisco 4

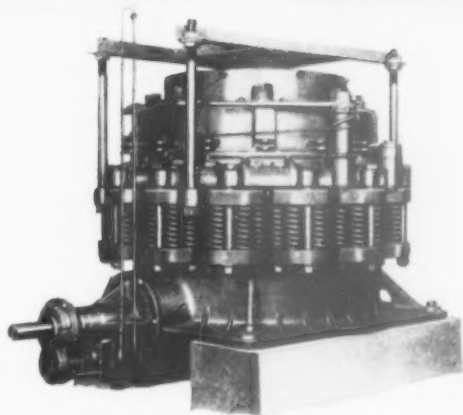
CB-1



**Graham Bros. Inc. install
their 4th SYMONS CONE CRUSHER
—based on performance of first 3**

That so many users continue to install additional Symons Cones to handle their increased fine crushing operation is proof of the satisfactory performance of these crushers. Further evidence of their superiority is the fact that there are more Symons Cone Crushers in use for fine reduction crushing than all competitive makes of gyratory reduction crushers combined . . . and a large proportion of all Symons Cones in service are repeat orders from satisfied users.

Available in Standard, Short Head and Intermediate types in a wide range of sizes, you'll find a Nordberg-built Symons Cone Crusher for practically every fine reduction crushing operation. Write for detailed information.



Graham Bros. Inc., of El Monte, Calif., originally had one 4 ft. and two 3 ft. Symons Cone Crushers in service. On the basis of their performance, a fourth Cone has now been purchased—a 5½ ft. unit.

CS05

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN

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NORDBERG

*Machinery for processing
ores and
industrial minerals*



Primary
Crusher



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Mine Hoist



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NEW YORK, N.Y.

"WE HEAR..."

October, 1950

Construction activity for the rest of 1950 isn't going to be much affected by the mobilization program outlined up to mid-August. According to the experts, only slight curtailments of peacetime construction activity will be necessary --unless war spreads beyond Korea, or outside troops come in there to help the North Korean forces now engaged.

The Maine State Highway Commission, impressed with recent advances in concrete manufacture, is said to be ready to reverse a long-standing policy and call bids for concrete highway paving. For many years the state shied away from concrete paving, because tough Maine winters broke down concrete paving faster than any other surfacing--or so commissioners believed. New cement components, promising a concrete that won't chip and crack under severe winter weather, have prompted the commission to consider a few stretches of such pavement as an experiment.

Inbound freight car shipments for Hungry Horse dam construction for the first 27 days of July are totaled at 206. These include 132 cars of cement, 61 of pozzolan and 13 of steel. The 206 total compares to 279 for the month of June, a record. There were no shipments during the first seven days of July, however.

Wild lumber price rises have raised basic construction costs to contractors and builders by 1.7 to 2.5 percent in the past month, and 10 to 11.5 percent in the past year, as measured by Engineering News-Record construction and building cost indexes. Labor rates have stabilized in that time, cement is up only 0.1 percent and mill prices for structural steel are unchanged.

States should put a moratorium on any increase in present motor vehicle size and weight limits pending completion of current investigations of road capacity and surface strength, according to a report by the Council of State Government. The study says that "if present axle loads are raised above the weight for which most of our highways were designed, there will be a loss of investment because of shortened road life, costly maintenance, and programs of highway improvements will be further postponed." As a maximum permissible load limit for trucks, the study recommends 18,000 lb. per vehicle axle; however, if the axles are less than 40 inches apart, they may be counted as one load unit.

Construction hit another new peak in August. Value of work put in place during the month on all kinds of construction is estimated at \$2.7 billion, or about \$800,000,000 above a year ago. This was a new high for the fourth month in a row.

Meeting an urgent request for help in repairing badly damaged roads in the country of Cambodia, the Economic Cooperation Administration has issued an authorization for \$91,000 worth of asphalt to be shipped from this country. It is expected that additional authorizations will be issued for road repair materials and equipment. Cambodia is one of the three associated states which formerly comprised French Indo-China.

WE HEAR

Building materials prices have been rising slowly, but the rise shouldn't be attributed entirely to Korea, according to W. D. MacDonald, regional director for labor statistics at Boston. He says that continuing heavy public demand for housing, plus rising wages, is responsible, and pointed out that the general rise is traceable to the beginning of the year, showing no significant spurts since Korea.

In areas where farm buildings in exposed locations are subject to winds of demolition force, asphalt shingle roofs are being made wind-tight by cementing down the shingle tabs. This prevents the wind from blowing underneath them to lift the roofing from the roof deck. Quick-setting asphalt cement is being used.

Consumption of industrial explosives in the United States declined to 631,230,005 lb. in 1949, according to the Bureau of Mines. This poundage was 13 percent below 1948 when consumption reached a record high total. However, the 1949 poundage was the third highest annual consumption. Type of explosive showing decline of greatest proportion was black blasting powder.

The 1950 Federal Aid Highway Act, passed by Congress and sent to the White House, authorizes \$500,000,000 annually for the federal aid system, to cover fiscal years ending in June, 1952, and June, 1953. The 1948 Act, which it replaces, authorized \$450,000,000 annually.

Because installations in alkali soils are subject to corrosive attack, highway engineers specified sulfate resisting cement for bridge, drainage and approach structures for the new Pueblo, Colo., freeway. Since the freeway installation was one of the first major projects in the area using this type, strength tests of the concrete were closely watched, and it was found that compression strengths were almost double those specified for the job.

Truck freight volume for July declined 3.2 percent from the preceding month but showed a 34 percent increase from loadings for the same month last year, according to reports by 300 carriers in 40 states. The volume carried in July amounted to 4,139,239 tons compared with 3,085,099 for July, 1949.

Cakes of mica, weighing up to 500 lb., have been formed at the Colorado School of Mines by a new "cool hearth" method. The process avoids use of crucibles and contains the molten mica in a basin of unmelted raw mixture from which the melt was derived. Crystallization takes place in this melting basin which forms a center pool surrounded by a solid cool mass of the unmelted raw mixture.

One of the sidelight results of Korea and the mobilization program may be an increase in union membership, according to Engineering News-Record. Most labor observers figure that the union movement reached its peak about 1947, and has been barely holding its own since then.

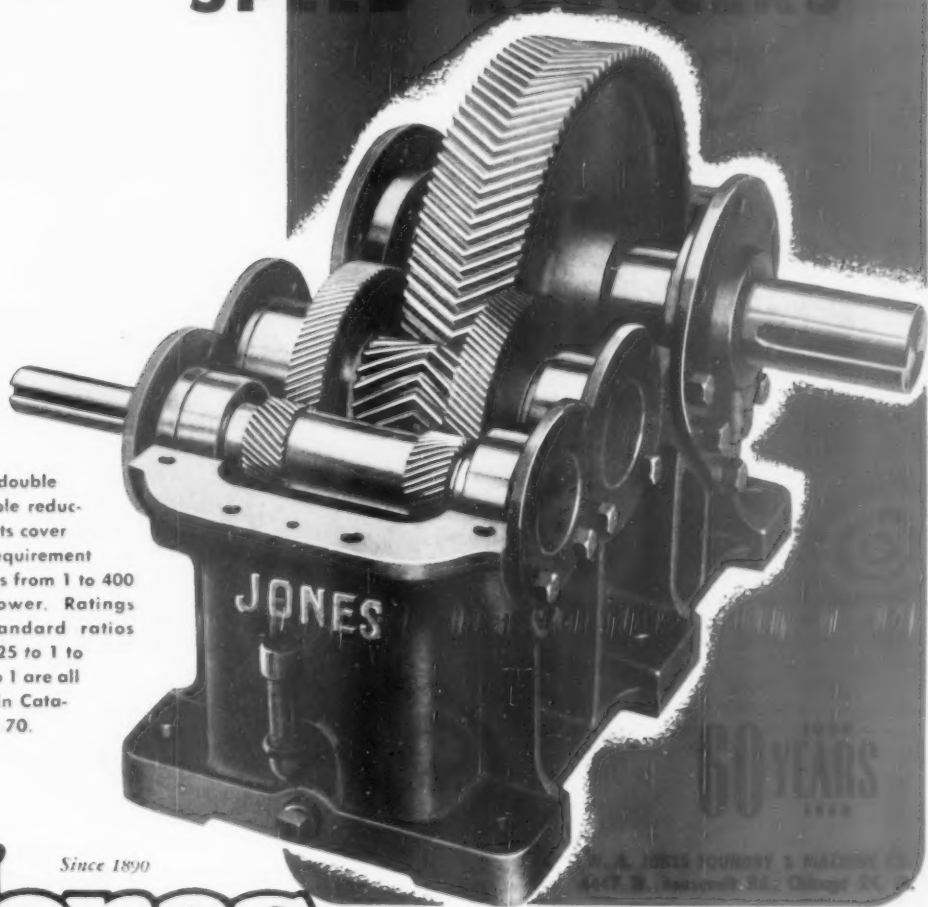
World production of natural rubber, spurred by the highest rubber prices in 26 years, set a new record in July for the second month in succession. Production for the month reached 187,500 long tons, 10,000 tons more than in June. However, world consumption of rubber, both natural and synthetic, during July fell about 7500 tons below the previous month to 182,500 tons.

A proposal that the government build and operate a \$250,000,000 freight car-leasing business has been placed before a House committee. It was stated that recent car shortages had affected not only "substantial areas," but the "entire nation" as well. The committee is considering the proposal to establish a Railroad Car Reserve Corp., to send publicly-owned cars into areas of car shortages.

THE EDITORS

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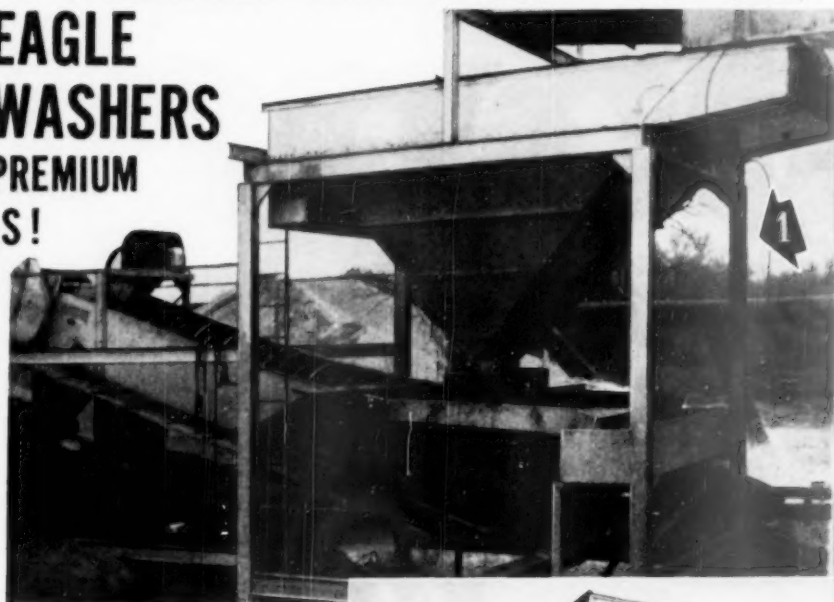
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★ ★ ★ Editor's Page

Cement Concern Invites Labor Leader to Board Meeting

AN UNPRECEDENTED event in labor-management relations took place on July twenty-fifth in Denver, Colorado, when General President William Schoenberg of the United Cement, Lime and Gypsum Workers International Union attended a meeting of the board of directors of Ideal Cement Co.

Mr. Schoenberg's union, a few weeks earlier, had reached a joint agreement with the cement company, through a process of collective bargaining which he considered as conducted under highly favorable circumstances, that resulted in establishment of a pension plan and a pattern of uniform working conditions to prevail for all plants of the company.

After completion of the transaction and signing of the agreement by company officials and union officers, C. K. Boettcher, president of Ideal Cement Co., invited the union chief to come to Denver to attend the board meeting.

Mr. Schoenberg spoke informally at the meeting. He was out-spoken in his expression of appreciation for the invitation to be present, which action, he said, would reflect profitably for the company, the workers, and the public interest.

Unprecedented Event

It has been rare indeed in any industry and, to our knowledge, it has never happened before in the rock products industries, that top level union leaders have had such an opportunity extended to meet with top leaders of capitalistic interests.

This meeting, under such favorable conditions, between the top leaders representing ownership of a business and labor, came at a time when there is greater need for unity between management and labor possibly than ever before in the nation's history. Ideal's initiative, in inviting a labor chief to a meeting of financiers and big stockholders, normally closed to all outsiders, was a step taken in the direction of letting down the barriers in order to encourage and foster greater understanding of mutual problems between workers and responsible owners of a business. That's what is needed today more than anything else in order to eliminate misunderstandings and to achieve the unity that is so vital to our economy and to the national interest.

With all the pension and welfare plans being adopted by individual companies in industry, labor unquestionably is becoming more and more an actual participant in capitalistic enterprises. As the movement to more pension plans gains, the worker will no longer be able to consider himself

apart from the "capitalism" that he has been taught by some unions to hate; he will have a greater stake in it and, as a result, the time is coming when he will become more concerned, and rightfully so, with the workings of a business.

Labor's Stake in Industry

Whether monies paid into pension funds be invested back into the company providing the pensions, or in other enterprises or in government bonds, the investment is being made either directly or indirectly into industry, which is capitalism, and thus the worker becomes a partner in the capitalistic system. He will be vitally interested in the success of business enterprise, more than he was a few years ago, because pension plans are useless unless the funds are always available for payment at maturity.

Maybe the day will come, as some have predicted, when a representative of labor may regularly sit in on a board of directors meeting of his company, if not by invitation to membership, as an appointed representative of the interests administering the company pension fund.

Possibly, that might be a good thing. At least, labor then would have opportunity to experience first-hand the hardships and problems confronted by companies as they struggle to make profits, often under extremely unfavorable circumstances, in order to create job opportunities, profits for stockholders and funds from which to pay salaries and pensions. Labor would then learn that capitalists earn money, not just make it.

Getting back to the Ideal Cement Co. directors' meeting, union president Schoenberg enthusiastically publicized the event in the official publication of his union. He assured members of his organization that the cement company was sincere in its expressed desires to cooperate with workers in its plants, and he called upon the workers to put forth their best efforts.

Obviously, the terms of the pension agreement and working conditions agreed upon were satisfactory to the union, or Mr. Schoenberg could not have been as enthusiastic as he was in expressing his great pleasure in being invited to the board meeting. The important point was that he was given, in an unprecedented way, recognition and the assurance that the company was prepared to contribute its part to the attainment of unity.

Bior Nordberg



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Rocky's NOTES

Nathan C. Rockwood

Highway Engineers as History Makers

HISTORIANS AND NOVELISTS have managed to find considerable "romance" to write about in the building of railways, but few have turned their talents to the little less romantic achievements of the builders of our modern system of highways. Possibly this continental network of paved roads is too recent an accomplishment to be viewed in retrospect. In any event, probably no group of public servants has contributed more to our rational enjoyment and to our actual first-hand knowledge of this country than our modest highway engineers. If love of country, or patriotism, means acquaintance with and love for "thy rocks and rills, thy woods and templed hills," as our song "America" has it, our highway builders have done a great deal more for their country than they are given credit for.

This thought is prompted by a perusal of the *California Highways and Public Works*, centennial edition, dated September 9, 1950. This is the official monthly journal of the Division of Highways, Department of Public Works, State of California. Every copy of this magazine we have seen has been interesting and instructive, both on account of articles contributed by members of the engineering staff, and because of the very fine pictures of California landscape. But this September issue is something out of the ordinary. It is a highly interesting and entertaining history of trail-making and highway-building in California from the days of the earliest Spanish settlement—in 168 pages of text and illustrations.

The centennial celebrated is the 100th anniversary of admittance of California into the Federal Union in 1850. Prior to that, like Texas, the present State of California was briefly an independent republic, won from Mexico by invading settlers from our central and eastern states. More than some of the states in between, California is rich in all kinds of history, and its story has been told in many thousands of volumes. Here in this single magazine are many of the most significant details of that history in an easily assimilable form, which certainly should render a trip over the highways both enjoyable and instructive from more angles than viewing the scenery.

Varied Topography

To the engineer visitor probably the most potent fact is that California has the greatest variety and contrasts in climatic and topographical conditions to be found in any single American state. Consequently highway builders there have had to contend with every natural obstacle to be found anywhere in the world, from snow-capped mountains, deep narrow canyons and torrential streams, to hot, dry deserts of shifting sands. Unlike the average tourist, the engineer visitor can form some appreciation of the technical talent that went into the state's present magnificent system of highways, which are all the product of the past 40 years, or we may say, largely the work of a single generation of highway builders.

It was only about 100 years ago that the first wheeled vehicles began to find ways of getting from the Missouri River to California, but before that, as early as 1826, fur traders had blazed trails into what is now Los Angeles, by a southern route through Texas and Arizona, which in California and Arizona is now practically the route of U. S. 66. In 1849, some 23 years later, wagon trains started rolling over this and other routes farther north. The greatest difficulties, of course, were encountered in getting over and through the mountains, and particular attention is given in this account to the various mountain passes and when and how they came to be used. Mighty few tourists as they glide along at 60 or more miles an hour on smooth, paved highways can form any idea of the difficulties and hazards of those pioneers who first used these mountain passes.

From Chapter XIII—Start of the Highway System—we learn that "the story of the Division of Highways of the Department of Public Works had its beginning back in 1895. In that year California, by act of the legislature, created the State Bureau of Highways, and acquired the Lake Tahoe wagon road, a pioneer toll road, as the first state highway." This was a 65-mile stretch from Placerville to the eastern boundary of the state, one

of the routes most used by the pioneers. As a toll road, in the year 1862 alone, it was used to haul 30,000 tons of freight and 36,500 passengers, providing an income in that year of \$4,000,000 to the owners. It is now part of U. S. 50.

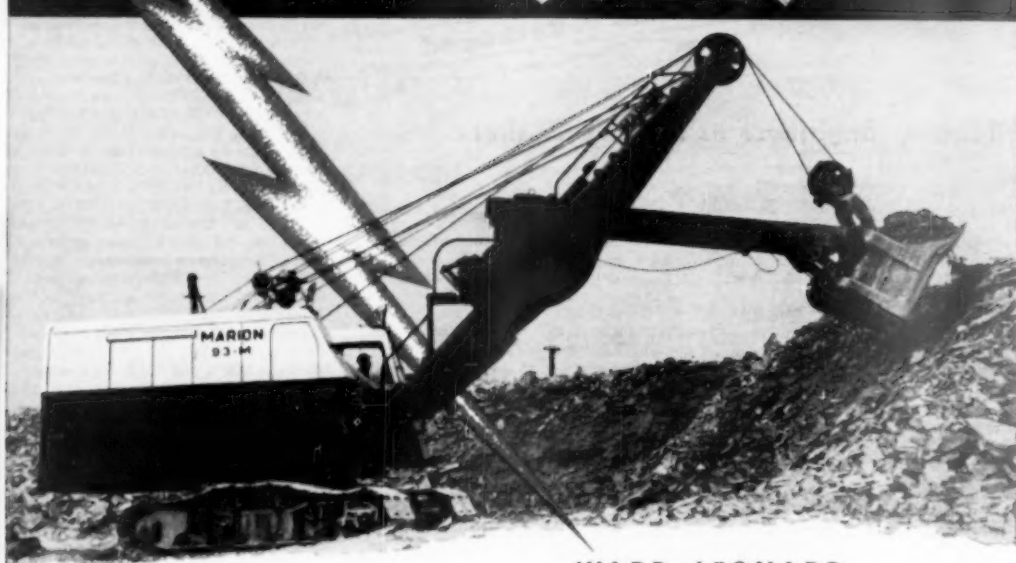
It was not until 1910 when automobiles began to be used in increasing numbers, that state highway construction started in earnest. In the interim many miles of railway were constructed and highway authorities could not see the need for a state-wide system of hard surfaced roads. The 1909 session of the state legislature authorized a bond issue of \$18,000,000, which supplied funds in 1910 for the start in state highway construction. In 1915 a second bond issue of \$15,000,000 was authorized, and in 1919 a \$40,000,000 bond issue. But this \$74,000,000 is sum total of all the State of California went into debt for highway construction. Its present system of 14,000 miles of surfaced highways, representing a total investment of nearly \$1½ billion, has since 1920 been constructed, repaired and maintained on a pay-as-you-go basis. At present about \$100,000,000 a year is being spent, or more than 25 percent in excess of the total of the three bond issues.

Structures—Materials

There is a particularly interesting chapter—"A Century of Bridge Progress"—which gives an account of the evolution in highway bridge structures, from log culverts and brush filled gulleys to modern concrete-arch and girder spans. The author states that in the century there were perhaps 50,000 bridges constructed, of which some 30,000 are yet standing, but there is still a great demand for more bridges. Some 72 percent of the bridges or viaducts built today are for highway grade separations because of the insistent demand for "freeways."

T. E. Stanton, materials and research engineer, whom many of our readers know personally, contributed Chapter XIX, in which he describes briefly the development of his division since its beginning in 1921. Perhaps it is typical of state highway departments in general, that the materials and research work are still done in cramped and inadequate quarters in a building erected in 1921, to which only two wings have been added. However, a new and larger laboratory is contemplated. Mr. Stanton writes modestly of the work done in this laboratory under his direction, but the fact is, as most of our readers know, that it is one of the very few state highway laboratories where any discovery of importance in pure science has been made. This was the determination that the reaction between certain siliceous aggregates and the free alkali in modern portland cements accounted for some badly deteriorated concrete—probably the most important discovery concerning concrete in the last 20 years.

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LABOR RELATIONS TRENDS

Picketing Limitations and Seniority Problems

By NATHAN C. ROCKWOOD

AN IMPORTANT DECISION in respect to secondary boycotts was made by the U. S. Circuit Court of Appeals, 10th Circuit, Denver, Colo., August 14. It involved a typical case of an A. F. of L. building trades union's attempt to compel an innocent party to refrain from handling the products of a non-union or black-listed employer. There used to be many similar examples, but the Taft-Hartley Act put a ban on secondary boycotts, and at the same time tried to protect the right of free speech and assembly, guaranteed by the Constitution to the limit. This provision is what most aroused the ire of labor bosses.

The National Labor Relations Board, which apparently has always had a leaning toward the labor-union side of any controversy, long held that "peaceful picketing" for such a purpose was merely an exercise of freedom of speech. The Board had a U. S. Supreme Court decision of 1940 to bolster its stand. After the passage of the Taft-Hartley Act, as distasteful to the N.L.R.B. as it was to some union labor bosses, the Board was faced with a dilemma, which came to a head in the early part of 1948, when the independent general counsel of the Board sought and obtained an injunction from the U. S. District Court at Kansas City, Mo., against the carpenters' union. The case was that of the Wadsworth Building Co., which was erecting some prefabricated houses, made by a concern which the carpenters' union was attempting to organize.

It will be recalled that under the Taft-Hartley Act, only the general counsel of the N.L.R.B. has the power to ask for injunctions. The employer can not. Hence, the replacing of Mr. Denham by some one yet to be named, at this writing, is very important to the functioning of the act. That is why the labor bosses were anxious to see him replaced.

Consistent readers of this page may recall that the decision of the U. S. Circuit Court of Appeals, 10th Circuit, Denver, upholding the temporary injunction granted by the lower court was abstracted in our issue of January, 1949, p. 57. That threw the case back into the hands of the N.L.R.B. In that article we said: "Nearly a year has passed since the District Court injunction and the N.L.R.B. has taken no action, which leads to the belief expressed above, that maybe it is dodging the issue for the time being at least." The Board finally had to make a decision, which it did with admitted "anguish," that the picketing of the Wadsworth Building Co. job was a violation of Section 8 (b) 4

(A) of the Taft-Hartley Act. Subsequently, the U. S. Supreme Court decided several cases which upheld the right of the various state governments to regulate picketing without infringing on the constitutional right of free speech.

Court Upholds N.L.R.B.

The present case is therefore the sequel to the January, 1949, Labor Relations Trends article, and ends the controversy over the meaning of the secondary boycott prohibition of the Taft-Hartley Act, unless the carpenters' union appeals to the U. S. Supreme Court and gets a reversal, which is not likely. For the District Court of Appeals confirms the N.L.R.B.'s "cease and desist" order against "an unfair labor practice," and establishes the legality of the Taft-Hartley Act's prohibition of even "peaceful picketing," if the object of such picketing is to coerce an employer to employ only union employees, or to attempt to blacklist another employer because he uses the products of a non-union producer or manufacturer.

The attorneys representing the carpenters' union contended that they were exercising their constitutional rights of freedom of speech and assembly. The court case was complicated by the fact that the firm of manufacturers of the fabricated houses was subsequently dissolved, and one partner became a union bricklayer, and therefore was not interested in pursuing the issue. The contractor erecting the houses, the Wadsworth company, also settled its quarrel with the carpenters' union, by becoming union. These facts gave the union attorneys the additional argument that the case was now moot, and should be dismissed. However, the Court decided it was too important not to have a decision.

The decision reads in part as follows: "Certain findings of the Board are challenged. The findings are binding on the Court if they are sustained by substantial evidence. *** There is no need to detail at length the evidence tending to sustain the findings of the Board. It is enough to say that the material findings are sustained by substantial evidence and therefore must stand. Other contentions are advanced but they are without merit. A conventional order of enforcement will be entered."

Denver Case

The N.L.R.B. has since been forced to make a decision in a somewhat similar case involving a construction job in Denver by a non-union contractor,

to whom members of Denver Building and Construction Trades Council made threats, and whose job was picketed. The unions involved were the operating engineers, and the bridge and structural iron workers' unions.

First the unions tried persuasion without success, then threatened to establish and did establish a picket line, which they attempted to defend as a mere form of persuasion. The N.L.R.B. examiner decided in favor of the unions' contention, but in view of the previous Wadsworth case, the Board was "constrained to reverse" the trial examiner's conclusion. After explaining the reasons for its previous stand, that such picketing was privileged, the Board said: "Of course, we are here determining the scope of the statutory provisions, not of the Constitutional guaranty of free speech. But in interpreting Section 8 (c) 'the free speech' guaranty of the amended Act [Taft-Hartley], it is our duty to follow the Supreme Court's present views on the status of picketing under the First Amendment [of the U. S. Constitution]. For there is nothing in the Act or in its legislative history to indicate that Congress intended to go beyond the protective scope of the Constitution in exempting the picketing activities of labor organizations from the various prohibitions contained in Section 8 (b). It follows that the Respondent's [unions'] picketing in this case and their threats to picket were unfair labor practices, for Congress outlawed the Respondents objective by Section 8 (a) (3) of the Act, and interdicted, in Section 8 (b) (2), all means other than mere persuasion, or 'views, arguments or opinion,' which a union might employ to achieve that unlawful objective."

Seniority Problem

The decision of an arbitrator in a dispute between the National Gypsum Co. and the United Cement, Lime and Gypsum Workers' International Union's local 74 is of general interest to those producers and manufacturers in these industries who may be faced with the problem of layoffs in the coming restrictions on our national economy. The issue involved was an interpretation of the contract clauses covering layoffs and seniority at the company's Rotan, Texas, plant. Three women employees were involved, who were hired during the recent World War when employees were scarce. They wouldn't have been employed if men were available.

January this year, the management notified the three ladies that it had run out of work for them, but that they would be called when needed. They claimed that they were regular employees with greater seniority than the majority of other employees, which indeed was the case if they could be construed to be regular employees. The contract provisions covering layoffs read as follows:

"Article 5: (A) Seniority shall be

(Continued on page 136)



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RYERSON STEEL

the *Personal Side* of the news

Officers of Committee C-1

THE NEW OFFICERS of Committee C-1 on Cement, of the American Society for Testing Materials, elected at the recent Atlantic City, N. J., convention are R. R. Litehiser, chairman; W. C. Hanna, vice-chairman; and W. S. Weaver, secretary. Col. Litehiser is chief engineer, Ohio State Highway Testing and Research Laboratory, Columbus, Ohio. W. C. Hanna is chief chemist, California Portland Cement Co., W. S. Weaver is research engineer of the Canada Cement Co., Ltd. They succeed F. H. Jackson, Federal Bureau of Public Roads; W. H. Klein, vice-president, Lawrence Portland Cement Co., and George E. Warren, president, Southwestern Portland Cement Co., respectively.

A new secretary of Committee C-11 on Gypsum was also elected. He is L. H. Yeager, secretary of the Gypsum Association. He succeeds C. E. Abbey, who is also with the Gypsum Association.

It was erroneously reported in our August issue that the former officers of these committees were re-elected.

Fair Board Director

PHILIP E. HEIM, vice-president in charge of sales for the Carbon Limestone Co., Youngstown, Ohio, and one of the directors of the Canfield Fair Board, was in charge of publicity and public relations for the 104th annual fair held recently in Canfield. Born in Painesville, Ohio, Mr. Heim spent his boyhood on a farm, and graduated with a B. S. degree from Ohio State University, College of Agriculture, with a major in animal husbandry. During World War I, he taught animal husbandry in the vocational training school at Camp Sherman. He was the first serviceman for the Ohio Farm Bureau and was stationed in Lisbon, Ohio. He also did farm extension work at Bellaire, Mich., and owned a farm until a short time ago. He has been active in 4-H work since 1915.

Sales Manager Retires

WALTER E. BOWE, Maine sales manager for the Lawrence Portland Cement Co., New York, N. Y., has retired due to ill health after more than 26 years of active service with the company. He has been Maine sales manager for the past seven years and previously was district sales manager in charge of the Boston office. He will continue to be connected with the company in the capacity of special representative, giving advice and counsel whenever needed. As a result of Mr. Bowe's retirement and the death of George W. Hinkley, who was

acting sales manager for several months during Mr. Bowe's illness, the Augusta office has been placed under the supervision of the Boston sales manager, R. H. B. Smith.

Owens Concrete Firm

RALPH J. WATSON has become the principal owner, president and manager of the Colorado Concrete Manufacturing Co., Colorado Springs, Colo., succeeding E. C. van Diest, who died August 1. The concrete firm was organized and started operations in 1912, supplying concrete sewer and drainage pipe, grease traps, meter pits and many other concrete products. Mr. Watson was formerly associated with the Brookhart Lumber Co., the General Service Corp. and the Utah Ice and Storage Co.

Chief Engineer

WALTER F. WINTERS, formerly special projects engineer at the Denver office of The Asphalt Institute, New York, N. Y., has been promoted to chief engineer, with headquarters in New York City. Bernard Gray, who has been serving as both president and chief engineer, has relinquished the latter post to devote full time to his duties as president. Mr. Winters received his engineering training at Washington State College, with supplementary courses at the University of Virginia and Northwestern University. He has had 19 years of engineering experience in the state of Washington and has been associated in recent special projects work with the Bureau of Reclamation and the U. S. Corps of Engineers.



Walter F. Winters

Mineral Wool Specialist

JOSEPH S. TANTILLO, Chicago, Ill., has returned from Pueblo, Colo., where for the past several months he has been engaged in the design and erection of a new mineral wool plant for Rock Wool Insulating Co. Mr. Tantillo, for many years, was associated with the Whiting Corp., Harvey, Ill., in charge of the mineral wool division, and has had active part in the building and design of many outstanding plants in the industry. He tells us that he is now available for consulting practice or desires permanent association with a wool manufacturer, engineering firm or manufacturer of equipment serving the industry.

Celotex Appointments

E. E. DIECKING has been appointed assistant general sales manager of The Celotex Corp., Chicago, Ill. He was formerly manager of the Chicago sales branch and will be succeeded in that position by J. E. Varlie, who has been assistant manager at Chicago. I. W. Hally, formerly assistant manager of the Philadelphia branch, has been appointed manager, succeeding H. E. Mansfield who has resigned. W. J. Manton has been named sales representative in the Nebraska territory under the Minneapolis branch. He was formerly sales representative in the New York branch and will now make his headquarters at Grand Island, Neb.

Becomes Partner

J. F. HILL is co-owner and manager of the Bandera stone quarry near Redfield, Kan. He is in partnership with Mr. Van Nostrand, Tulsa businessman, who bought the quarry from the late R. S. Gilfillan about five years ago. L. B. Shell, co-owner with Mr. Van Nostrand for the past five years, has sold his share of the Redfield firm and moved to Commerce, Okla.

Heads Construction Firm

FORD J. TWAITS, former president of Consolidated Rock Products Co., Los Angeles, Calif., and a director of the National Sand and Gravel Association, Washington, D. C., is president of the Ford J. Twaits Co., construction engineers of Los Angeles, and also the City Park Garage, Inc.

On Board of Directors

WALTER H. WULF, president of The Monarch Cement Co., Humboldt, Kan., has been elected a member of the board of the Eastern Kansas Utilities, Inc., Fort Scott, Kan.

Seabees Need Men

DEPARTMENT OF THE NAVY, Washington, D. C., has announced the need for skilled construction men for the Seabees. S. F. Stowe, public information officer of the U. S. Navy Seabees, stated that the Reserve is far below the needed strength of 75,000 in case of full-scale war.

The Seabee ratings open are for builder, mechanic, steelworker, utilities man, construction electrician, driver and surveyor; these seven ratings cover some 60 different civilian construction skills.

The Navy also announced that skilled construction men over the age of 25 can still enlist in the Reserve and receive petty officer ratings equal to their civilian experience. Volunteers will be placed on inactive duty, with no drills or required meetings, but they may be called to active duty when required. Those in the 19 to 25 age group are not eligible to join the standby Reserve, because they have become subject to induction under the Selective Service Extension Act of 1950.

Wins Safety Trophy

MARQUETTE CEMENT MANUFACTURING Co.'s Des Moines, Iowa plant was re-awarded the Portland Cement Association's safety trophy which it first won in 1942. The plant personnel have worked 936 consecutive days without a lost-time accident and the quarry division has a safety record of 2183 consecutive accident-free days.

The award was made at a special ceremony and picnic held at the plant August 10. Those in attendance included plant employees and their families, Des Moines' mayor, A. B. Chambers, and officials of the Des Moines Safety Council, American Red Cross, Marquette Cement Manufacturing Co., and the A. F. of L. Union.

General Sales Manager

GAYLE R. DUTTON has been appointed general sales manager of the Layrite Concrete Products Co., Spokane, Wash. J. H. Abrams has been named manager of dealer sales and James Breen has been made manager of Spokane city sales.

Elected Vice-President

RALPH H. CAMPBELL, manager of the white cement sales and export department, Medusa Portland Cement Co., Cleveland, Ohio, has been elected vice-president in charge of white cement.

Safety Awards

SAFETY CERTIFICATES have been awarded to Federal Portland Cement Co., Inc., Buffalo, N. Y.; Louisville Cement Co., Akron, N. Y.; National Gypsum Co., Akron, N. Y.; and Uni-

versal Atlas Cement Co., Clarence, N. Y.; for perfect safety records in the 25th annual safety campaign of Association Industries of New York State.

Sentinels of Safety Trophies Awarded

PRESENTATION OF the Sentinels of Safety awards to the six top winners of the National Safety Competition was recently made by the Bureau of Mines. These trophies, provided by *The Explosives Engineer* magazine, were awarded to the five mines and one quarry that achieved safety records during 1949. In making the awards, the bureau revealed that in 1949 the mineral industries attained the best safety record in the history of the contest.

When the National Safety Competition was started by the Bureau of Mines in 1925, not a single participant worked the entire year without a lost-time accident. In the 1949 contest, 202 of the 646 mines and quarries enrolled reported injury-free records.

The 1949 winners of the trophies include Bellefonte mine, National Gypsum Co., Bellefonte, Penn., in the nonmetallic mines classification.

Appointed Ceramics Engineer and Geologist

JOHN E. FUNNELL has been appointed ceramics engineer and economic geologist of the Southwest Research Institute, San Antonio, Texas. A graduate of Virginia Polytechnic Institute, Mr. Funnell's special fields of research are ceramic engineering, glass technology, raw materials evaluating and processing, and regional mineral survey work. He has been with Carnegie-Illinois Steel Corp. as a control engineer and with Corning Glass Works as a research ceramist.

C. of C. President

PERCY L. ROGERS, chemist at the Front Royal, Va., plant of the Riverton Lime and Stone Co., Riverton, Va., has been elected president of the Chamber of Commerce of Front Royal and Warren County.

Institute President

PAUL J. KREMER, controller and assistant treasurer of the Buffalo Slag Co., Buffalo, N. Y., has been elected president of the Buffalo Control, Controllers Institute of America.

Injury Rates

THE NATIONAL SAFETY COUNCIL, Chicago, Ill., reports that 1949 injury rates were 5.18 disabling injuries per 1,000,000 man-hours in the cement industry. This was a reduction of 24

percent from 1948. The severity of time charges per 1000 man-hours in this industry was 2.21 days. This was a reduction of 19 percent from 1948.

The frequency of quarry disabling injuries was 17.43 per 1,000,000 man-hours, a reduction of 9 percent from 1948. The severity of quarry accidents in time charges per 1000 man-hours was 4.02 days. This was an increase of 19 percent from 1948.

Accident frequency rate for employees in all industries, based on the number of disabling injuries per 1,000,000 man-hours was 10.14 in 1949, a reduction of 12 percent from the year before. These statistics have been released by the Council in advance of the 1950 edition of its annual statistical yearbook, "Accident Facts."

OBITUARIES

JAMES R. FAIRMAN, assistant to the vice-president of the Pennsylvania-Dixie Cement Corp., New York, N. Y., passed away August 3. He was 64 years old. Born in Kansas City, Mo., Mr. Fairman graduated from the University of Missouri in 1909 with a B. S. degree in civil engineering. He joined the Portland Cement Association in 1920, becoming regional manager in charge of the Eastern offices at New York, N. Y. In 1937 he resigned from this position to become assistant to the vice-president of Penn-Dixie.

FREDERIC E. BAGER of The T. L. Smith Co., Milwaukee, Wis., died September 10 at his home in South Milwaukee. He was 81 years old and had been with the company since 1919. Mr. Bager was born in Sweden and came to the United States as a young man. He graduated from Cornell University and for many years had been active in the development of construction and industrial machinery. He was associated with the Bucyrus Co., now Bucyrus-Erie, before joining T. L. Smith Co.

HARRY DIEDRICH BAYLOR, vice-president of the Louisville Cement Co., Louisville, Ky., died August 25. Mr. Baylor came up from the job of chemist and was well known and universally respected in the cement and concrete industry for his technical knowledge and ability. He was active for many years up to the time of his death on technical committees of the American Society for Testing Materials and the American Concrete Institute.

CHARLES W. MAXWELL, president of the Albany Gravel Co. and the Ready Mix Concrete and Supply Corp., Albany, N. Y., died August 21. He was 52 years of age. One of the founders and first secretary of the gravel concern, Mr. Maxwell formerly was associated with the Richard Hopkins Co.



The entire sales organization of Huron Portland Cement Co., Alpena, Mich., recently visited the plant of Besser Manufacturing Co. in Alpena. The illustration shows the group of Huron and Besser representatives in the development room enjoying coffee and doughnuts. The representatives are: (1) T. W. Murray, Huron; (2) R. F. Dickson, Huron; (3) Clem Mason, Besser; (4) A. J. Cross, Huron; (5) J. A. Besotte, Huron; (6) P. M. Park, Besser; (7) C. H. Foster, Huron; (8) R. A. Whitker, Huron; (9) A. J. Vollmer, Huron; (10) J. F. Livingston, Huron; (11) D. R. Fox, Besser; (12) A. E. Harney, Huron; (13) Jack Sullivan, Besser; (14) R. M. Douglas, Besser; (15) D. T. Meyers, Huron; (16) C. L. Loude, Huron; (17) R. D. Acker, Huron; (18) J. A. Kauer, Huron; (19) B. E. Miller, Huron; (20) Elroy Bobolfs, Besser; (21) F. G. Welsch, Huron; (22) C. F. Arick, Huron; (23) C. A. Kane, Huron; (24) F. S. Long, Huron; (25) H. N. Ferris, Huron; (26) L. C. Hamilton, Huron; (27) J. W. Wagner, Huron; (28) A. R. Brodine, Huron; (29) D. D. Bryan, Besser; (30) E. J. Farr, Huron; (31) W. T. Duggan, Huron.

Industrial Minerals Division A.I.M.E. Regional Meeting

THE INDUSTRIAL MINERALS DIVISION of the American Institute of Mining and Metallurgical Engineers will hold its fall regional meeting October 17-20, at Norman, Oklahoma. The technical sessions will be held at the University of Oklahoma Extension Study Center. The program for the four days will include field trips into the Arbuckle Mountains. Some of the main features of the field trips will be the inspection of industrial mineral deposits and operating plants, and the study of the structural features of the rock of the Arbuckle Mountains. W. E. Ham is to be the field trip leader.

Papers to be presented at the technical sessions will include: "Trends in the Industrial Mineral Development of the Southwest," by Harold N. Foxhall, director of Arkansas Geological Survey; "Geology and Industrial Minerals of Oklahoma," by Robert H. Dott, director of Oklahoma Geological Survey; "Chemical Grade Limestone and Dolomite in Oklahoma," by Homer Dundan, president of St. Clair Lime Co.; "Industrial Minerals of the Arbuckle Mountains, Oklahoma," by William E. Ham, Oklahoma Geological Survey; "Chats in the Tri-State District," by Ernest Blessing, U. S. Geological Survey; "Salt in Kansas," by Earl Nixon, Kansas Geological Survey; "Specifications for Specific Uses of Limestone and Dolomites," by Ed-

ward Clark, director, and Mabel E. Philips, chemist, Missouri Geological Survey; "Barite Production in Missouri," by Garrett A. Muilenberg, Missouri Geological Survey; "Industrial Minerals of Texas," by John T. Lonsdale, director of Texas Bureau of Economic Geology; and "Geologic Setting for Potash Deposits in Southeast New Mexico," by Joe P. Smith, U. S. Potash Co.

Occupational Draft Deferments Listed

THE DEPARTMENT OF COMMERCE, at the request of the Department of Defense, has published a tentative list of essential industries which is to be used as a guide for calling up civilian employees for active duty in the Armed Forces. Likewise, the Department of Labor was asked to publish a list of critical occupations.

The rock products industries are covered in the Essential Activities List in Major Group-14, Mining and Quarrying of Nonmetallic Minerals, except fuels. The list of critical occupations is divided into two groups: professional and related occupations, and skilled occupations. Under the first group are listed geologists and engineers. Branches in the engineering category include chemical, ceramic, civil, electrical, industrial, mechanical, mining, petroleum, sanitary and marine; however, this listing pertains only to the professional, and does not

include manual laborers. Under skilled occupations are machinists, maintenance mechanics and foremen of critical occupations.

Research Laboratory Completed

MINE SAFETY APPLIANCES Co. held dedication exercises in Pittsburgh, Penn., June 14, in honor of the completion of its research laboratory which will be devoted entirely to the development of safety equipment for all industries. About 400 leaders in safety and industrial hygiene and health, as well as top industrial executives, attended the dedication.

The new laboratory is considered to be the largest of its type in the world and will be used primarily in developing equipment and devices to combat hazards of all types. Nearly every branch of science and engineering is utilized at the laboratory, which is staffed by chemists, physicists, electrical engineers and other scientists. Among the projects already planned will be research in relatively new fields such as atomic energy and air pollution.

AMERICAN PEAT & ROCK Co., Daytona Beach, Fla. has terminated its business, due to the death of its president, W. Sterling. The company interests have been absorbed by the American Development Corp.

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INDUSTRY *News*

Lone Star's Roanoke Plant

LONE STAR CEMENT CORP., New York, N. Y., is making rapid progress in the construction of its new cement plant at Roanoke, Va., which is being built at a cost of more than \$6,000,000. The work is being done by the Ralph E. Mills and Walsh construction companies.

A crushing plant is to be built at the lower end of the property near the limestone quarry, with a capacity of about 500 t.p.h. A belt conveyor, about 1000 ft. long, will convey the crushed material to the storage building, where crushed shale will also be stored after being processed through the same equipment as the limestone. The storage and adjoining mill building will be constructed entirely of concrete and the roof will be of arch construction on a 77-ft. span. Two overhead cranes will travel the full length of the storage building.

The mill building will house five ball mills and tube mills for the grinding of raw materials and clinker. The material from the raw mill will be transported by pneumatic conveyors to the raw mix silos which are to serve as storage and blending tanks. There will be two 10- x 340-ft. rotary kilns, each of which will produce about 2000 bbl. of clinker per 24-hr. day. There will be 15 cement storage silos, 26 ft. dia. x 120 ft. high, each holding about 13,000 bbl. of cement.

About 6000 hp. will be required for the operation of this plant, the power to be supplied by the Appalachian Power Co. Other features of the plant will include a machine shop, store-room, locker and shower facilities, large hall for conferences, safety meetings, etc., recreation and lunch room, and an office building. Construction of the plant is expected to be completed about the end of the year.

Gravel Plant Completed

BECKER COUNTY SAND & GRAVEL CO., Detroit Lakes, Minn., has completed its new large capacity sand and gravel plant at a new pit location at Detroit Lakes. Gravel is stockpiled over an underground tunnel through which a conveyor belt passes to load gondola cars. A hopper extends into the tunnel under each stockpile. The gravel is blended to required specification by withdrawal from the separate sizes over the tunnel.

Most of the plant's present production is going into the construction of Garrison dam in North Dakota which requires extremely close control of the

sand to meet specifications set up by the Army engineers.

Buildings at the new site include a tower structure which houses the crushing and screening equipment, administration building, maintenance shop and a laboratory. About 1000 hp. in connected electrical power is required for the plant's operations.

The plant was recently host to a group of visitors on an inspection tour of the plant. Among members of the inspection party were representatives of the U. S. Army Corps of Engineers, Minnesota and North Dakota highway department officials, and representatives from railroad, cement and construction companies.

Heading the activities of the plant

are R. N. McGiffert, in charge of Minnesota operations of the company, John Bently, company manager, and Fred E. Warner, superintendent.

To Open Quarry

CAMPBELL LIMESTONE CO., INC., Knoxville, Tenn., has announced plans to open a stone quarry near Pacolet, S. C. R. S. Campbell, Jr., president of the firm, has negotiated a loan, not to exceed \$400,000, from the Merchants and Planters National Bank of Gaffney, S. C., and the American Trust Co., Charlotte, N. C., according to a mortgage filed at the Gaffney court house. The company also operates plants at Gaffney, S. C., and Liberty, S. C.



Manitowoc Portland Cement Co., Manitowoc, Wis., replaced a kiln section with an all-welded unit shown here being lifted into place with a Manitowoc Speedcrane. A section 22 ft. long was replaced in the 10- x 150-ft. kiln. It is completely welded except for the mounting of the fire and the joint with the older sections of the kiln. The unit, made by Manitowoc Engineering Works, is constructed of 3/4-in. plate with the addition of two doublers, one 8 ft. wide and one 4 ft. wide. The Speedcrane used had a 100-ft. boom and had to raise the section from the flat car at a 37-ft. radius.

Cement Plant Program Completed

SOUTH DAKOTA STATE CEMENT PLANT, Rapid City, S. D., has completed its \$1,500,000 expansion program and is now producing over 4000 bbl. of cement a day, which is double its previous production rate. Frank Gardner, plant manager, has stated that, "If we doubled our capacity again, we still wouldn't be able to meet the demand for cement." He added that the shortage of cement throughout the country has resulted in calls for cement from as far away as Minneapolis, which is out of the plant's territory. The state cement plant now services South Dakota and the immediately adjacent states of Wyoming, Nebraska, southeast Montana and North Dakota.

An open house is to be held in the plant within the near future to permit the public to inspect the new facilities.

Synthetic Mica

DR. WILLIAM C. AITKENHEAD, research director at Colorado School of Mines, Golden, Colo., has announced that mica, an important mineral used in radar and radio equipment, and in electric motors, condensers, heating elements, aviation spark plugs, gas mask lenses, and many other products, can now be produced synthetically on a commercial scale by a process under study under an Army Signal Corps grant. Dr. Aitkenhead has stated that although large mica cakes were produced, there were "disappointingly few big individual crystals."

To Build Crushing Plant

WESTERN MASSACHUSETTS ASPHALT & STONE CORP., Pittsfield, Mass., has started construction of a stone crushing plant near Tunnel Rock Pile on West Shaft Road. The company stated that the estimated 1,000,000 tons of rock hauled out of the core of the Hoosac tunnel when it was built nearly a century ago will be used to provide road building material. The rock pile had been a liability until a recent change in state road specifications made it usable as a cheap source of raw material. The proposed plant will have three crushers. The plant will employ about 20 men.

Cover Picture

SHOWN IS THE compact stationary agricultural limestone plant of Arthur R. Alvis, Butler, Mo. Mr. Alvis is a member of the Board of Directors of the National Agricultural Limestone Association. In the foreground can be seen a Universal Pulverizer driven by a Caterpillar D375 diesel engine. A Universal jaw crusher driven by a Caterpillar D8800 diesel is visible in the right rear. The photograph was made by Caterpillar Tractor Co. The

tower at right supports a 24-in. dia. American Air Filter cyclone type air filter which supplies cleaner air to the diesel engine. A removable plate at the right angle joint permits water to be drained out in winter.

Seeks Dredging Permit

THE ERIE SAND & GRAVEL CO., Erie, Penn., has applied to the U. S. Corps of Engineers for a permit to dredge sand and gravel for commercial purposes in Lake Erie off Fairport Harbor. This dredging area is four miles long and one and three-quarters miles wide. Dredging from Ohio waters was banned entirely at the beginning of this year, but the state recently relented to permit dredging to get material for public works.

Buys Gravel Plant

JOHN E. WHISENAND has purchased all interests of Willis Heikes and Fred McCurtain in the Green River sand and gravel plant, near Rock Springs, Wyo. He will continue to operate the plant under the same name.

Changes Address

NATIONAL LIME ASSOCIATION, Washington, D. C., has moved its office quarters next door to its former location. The new address is 925 15th St., N. W., Washington, D. C.

Cement Plant Changes Operations

PENNSYLVANIA-DIXIE CEMENT CORP., New York, N. Y., has announced a change of operations at its Kingsport, Tenn., plant from the dry to the wet process in order to reduce dust to a minimum. The biggest change will be made in the kiln department. The six 8- x 125-ft. dry kilns will be replaced with one 12- x 500-ft. unit. It was reported that this new wet kiln will be the largest kiln in operation in the United States.

Other changes in the plant will include the installation of two groups of slurry mixing, blending and storage silos; and the coal handling and pulverizing will be changed from a central plant to a unit mill directly attached to the kiln.

Buys Sand Company

VON FRELICK, INC., has purchased the Montgomery Sand and Gravel Co., San Angelo, Texas. The purchase includes trucks, machinery and sand and gravel properties and leases on the North Concho and Colorado rivers. The plant, including shops and offices, will be combined with the Star Sand and Gravel Co. which Von Frellick, Inc., has been operating the last year and a half.

Coming Conventions

October 10-12, 1950—

National Industrial Sand Association, Semi-Annual Meeting, The Broadmoor, Colorado Springs, Colo.

October 12-14, 1950—

A. I. M. E., Industrial Minerals Division, Regional Meeting and International Mining Days, El Paso, Texas.

October 16-20, 1950—

National Safety Congress and Exposition, Stevens, Congress and Morrison Hotels, Chicago, Ill.

October 17-20, 1950—

A. I. M. E., Industrial Minerals Division, Regional Meeting, Norman, Okla.

October 24-26, 1950—

American Concrete Institute, Mayflower Hotel, Washington, D. C.

January 17-19, 1951—

National Agricultural Limestone Association, 5th Annual Convention, Hotel Statler, Washington, D. C.

January 22-25, 1951—

National Concrete Masonry Association, Annual Meeting and Concrete Industries Exposition, Cleveland Auditorium, Cleveland, Ohio.

February 5-9, 1951—

National Crushed Stone Association, 34th Annual Convention, and Agricultural Limestone Institute, 6th Annual Convention, Netherland Plaza Hotel, Cincinnati, Ohio.

February 11-15, 1951—

National Sand & Gravel Association, 35th Annual Convention, and National Ready Mixed Concrete Association, 21st Annual Convention, Roosevelt Hotel, New Orleans, La.

Amendment to Appropriations Bill

THE UNITED STATES SENATE recently voted on two important measures which are of primary interest to all agricultural limestone producers. The first was the elimination by the Senate Finance Committee of all new percentage depletion items (5 percent for stone, sand and gravel, 15 percent for chemical and metallurgical lime, and other items) from the Tax Bill H.R.8920. The second action was the passage of the Byrd-Bridges amendment which cuts the \$3,775,000,000 Appropriations Bill by 10 percent. However, even though the Byrd-Bridges amendment reduces the overall appropriations by 10 percent, it does not mean that the funds allocated for conservation materials will be reduced by 10 percent. The amendment gives to the head of each department and agency authorization to make such adjustments and transfers of funds within his own department or agency so as to effect a 10 percent reduction.

Defer Nonessential Construction

THE INTERIOR DEPARTMENT's order for postponement or curtailment of all of its construction programs which do not contribute to national security will not affect water and power projects, except where power output would be incidental. These projects will continue in full because of direct connection with national security. The Bureau of Reclamation has under construction 30 water and power projects, plus the 27-unit Missouri Basin project, but not all of these involve power production. Work also will continue on projects for municipal and industrial water supplies, on all small projects that can be completed this year and in the 1951 working season, and on the part of the work on any project which will furnish irrigation water by the end of the 1952 fiscal year.

Portland Cement Production

PRODUCTION OF PORTLAND CEMENT during July, 1950, as reported to the Bureau of Mines, increased 10 percent over the production for July, 1949. Mill shipments amounted to 23,167,000 bbl. during the month, 20 percent over the July, 1949, totals, while stocks of 12,840,000 bbl. were 34 percent below the July, 1949, figures. Clinker output in July, 1950, reached 19,809,000 bbl., 9 percent over the production reported for the corresponding month of 1949.

Cement Plant Expansion

FEDERAL PORTLAND CEMENT CO., Buffalo, N. Y., has announced plans for a \$1,000,000 expansion program. The main features will include an 11-x 375-ft. cement kiln, and a 50-x

400-ft. building to house the kiln. Harris N. Snyder, company president, has stated that the new kiln will increase output at the plant by more than 25 percent.

Cement Demand Ahead of Supply

CEMENT, NOW HIGH on the list of scarce materials, is becoming more expensive to buy. Alpha Portland Cement Co. has announced an increase of 10c per bbl. in bulk and 12c in paper bags, effective October 1. Pennsylvania-Dixie Cement Co. is reported as listing a 4 to 5 percent increase also, effective the same date. Most plants serving the St. Louis, Kansas City and Rocky Mountain areas raised their prices in September.

In Tampa, Fla., builders are paying over \$7 per bbl. on the gray market, against a list price of \$2.75. Elsewhere gray market prices are reported as high as three times mill quotations. A top executive of a major cement producing firm reports:

"Demand is running four times any possible availability now. Everybody is putting on the pressure to get a terrific amount of construction finished this year. But if they're dependent on cement, they may not get finished. The industry simply can't make the stuff any faster now."

Another large producer states: "We're pushing our mills to the limit—more came off our lines last month than ever in history—but the cement isn't even being warehoused. We're delivering right from the mill line."

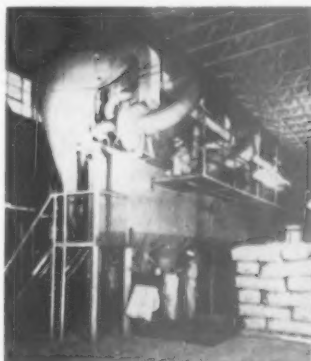
Three main factors underlie the short supply situation—unexpectedly high construction this year, the war in Korea and strikes.

Converts Lime Plant to Cement Manufacture

MOBA PORTLAND CEMENT CO., Los Angeles, Calif., a newly organized company, has announced plans to turn the old Cajon Lime Products plant, inactive since the early 1930's, into a 10,000 bbl. per day cement plant employing 150 people. The new firm plans to use the dry process for the projected new plant. It also plans to operate a limestone quarry five miles from the plant site. A belt conveyor will be built to transport the limestone from the quarry to the plant.

New Vermiculite Plants

ZONOLITE CO., Chicago, Ill., has announced the opening of two vermiculite processing plants. One plant is located in Los Angeles, Calif., and serves as an addition to the plant in operation at Sacramento. Raw ore for processing is supplied to the plant from the Zonolite mine at Libby, Mont. C. H. Wendel, president of the



View of vermiculite processing plant

California Zonolite Co., is manager of the new plant.

The other plant is in Jacksonville, Fla., and is under the direction of Robert H. Sterrett, president, and Harold K. Sterrett, vice-president of the Southern Zonolite Co. The Florida plant's raw ore comes from the Zonolite mine at Traveler's Rest, S. C.

The two plant additions are part of an overall Zonolite expansion program, bringing to 24 the total number of plants in the United States processing Zonolite brand vermiculite.

Pavement Yardage

AWARDS OF CONCRETE PAVEMENT for the month of August and for the first eight months of 1950 are listed by the Portland Cement Association as follows:

	Square Yards Awarded During August, 1950	During First Eight Months, 1950
Roads	2,890,246	21,983,918
Streets and alleys	3,508,560	19,621,691
Airports	189,819	2,320,501
Total	6,588,625	43,926,109

Opens Quarry

MERRILL M. GREEN AND L. M. GREEN have recently opened a quarry at Waverly, Mo., to be operated under the name of Green and Green Quarries. At the present time the quarry is employing about 16 men, and when in full operation, the plant is capable of producing 1400 tons of crushed stone daily.

Expansion Program

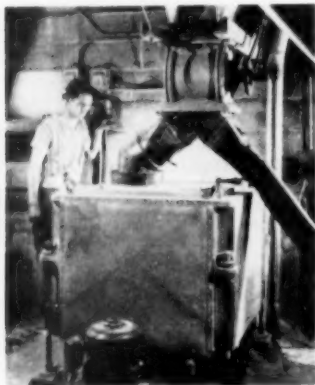
FAYETTE LIMESTONE CO., INC., Washington Court House, Ohio, has begun work on the construction of an additional agricultural limestone plant at an estimated cost of \$50,000. According to company officials, the new plant will have a capacity of 1600 tons of agricultural limestone a day. Alvin R. Armbrust is president of the firm.

HINTS and HELPS

PROFIT-MAKING IDEAS DEVELOPED BY OPERATING MEN

Steel Sifter Cuts Maintenance

The eastern plant of a vermiculite processing company encountered difficulty in the grading of its product because the heat of the material—



All-metal sifter for grading vermiculite replaced warped wooden unit

over 200 deg. F.—tended to warp the wooden sifter then in use. Recently the company replaced the wooden unit with an all-metal Allis-Chalmers Low-Head gyratory sifter. This unit is said to have eliminated the problem of warpage and to have cut down on maintenance. The sifter is grading three different sizes of vermiculite at the rate of 23 tons per day.

Air Tugger Over Primary Crusher

OVER THE PRIMARY CRUSHER at a dam project in the West, a small Ingersoll-Rand air tugger with a rope control has been installed. This permits the crusher operator to control the unit from his station beside the



Air tugger over primary crusher serves as hoist

crusher. Where air is available around jobs, this type unit serves as a very reliable and rugged hoist to remove crusher hang-ups. An air hoist reduces the danger of straightening hooks used, or otherwise breaking equipment because of excessive power applied.

Hard Surface Alloys Cut Costs

ADDED LIFE can be given to any dragline, bucket or dipper on a shovel by liberal use of hard surfacing alloys. There are many spots on shovels which can be protected. The illustration shows the dipper on a Northwest shovel handling granite rock that eventually will be used in a large dam now under construction on the Pacific Coast. It will be noted that the hard surfacing metal has been put on the outer cheek surface of the bucket and the striations are at right



Hard surfacing on bucket bottom decreases wear

angles to the radius of movement of the digging section. It makes a practical and cost saving addition to any shovel operation.

Freezing of Plug Valves Corrected

ONE OF THE OBJECTIONS to a plug valve is that when the valve is closed, the inner chamber can remain full of water. If liquid is flowing in the line at the time the valve is closed, and if the seat is tight, a full load of water will remain in the chamber (the chamber is that part of the valve through which liquid flows when the valve is in the open position). In cold weather valves can freeze and be cracked open. By drilling a $\frac{1}{4}$ - or $\frac{3}{8}$ -in. hole in one side of the valve and at the bottom of this chamber, trapped water will drain out automatically and help protect the valve.

The illustration shows a 5/16-in. hole at the tip of the arrow. The valve

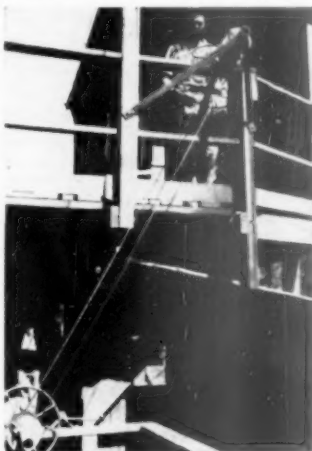


Arrow points to hole in plug valve through which trapped water can drain

is a Nordstrom lubricated plug valve and is in a line carrying rejects to a tailing pond at a western operation. Drilling the hole has not impaired the usefulness of this valve.

Hand Wheel Controls Flop Gate

AT THE AGGREGATES PLANT of a dam construction project in the West, two jaw crushers are in use. One is a 24- x 36-in. Diamond and the other is a 24- x 40-in. Cedarapids. Four sizes of aggregates are produced, the largest being the "cobble," or plus 3-in. minus 6-in. material. One crusher ordinarily is set at a different size than the other, as this arrangement permits a high degree of flexibility, and crusher settings can be changed to meet changing conditions in the pit. In a



Handwheel permits operator to change flop gate to crushers

similar manner, the amount of feed going to each crusher can be split by a "flop gate" so that the resulting crush of the two units gives an overall product to meet the needs of construction. To change the flop gate, a cable and handwheel arrangement has been provided so that the operator does not have to go downstairs to change the setting.

Portable Ready-Mixed Concrete Plants

WESTERN OPERATORS lean more toward ready-mixed concrete plants of compact and portable design. This contrasts with Eastern operators who in many cases have large investments in quite extensive permanent batching plants. Several companies in the West manufacture portable batching and ready-mixed concrete plants, most of which are essentially prefabricated and which can be erected very quickly.

In most instances, only the concrete footings need be provided before the erecting contractor places the pre-assembled units in position. One fabricator has a steel silo with the bucket elevator built inside the silo, and near the base is a feed screw conveyor also built into the unit. Such a portable cement silo was adjacent to the house shown, which incidentally was also portable and for convenience was mounted on sturdy sawhorses. This was not located at a construction job, but was at an established plant.



Portable ready-mixed concrete unit, right, with semi-portable eff. ce mounted on sawhorses in center

Number of shots in blast to be lighted by each man	Minimum length of fuse permissible for each shot			
	40 second fuse		30 second fuse	
	Inches	Time	Inches	Time
(1)	(2)	(3)	(4)	(5)
1	24	1 min. 20 sec.	30	1 min. 15 sec.
2	26		32	
3	28		36	
4	30	1 min. 40 sec.	39	1 min. 38 sec.
5	32		42	
6	34		45	
7	36	2 min. 0 sec.	48	2 min. 0 sec.
8	38		51	
9	40		54	
10	42	2 min. 20 sec.	57	2 min. 22 sec.

Table of fuse lengths

Bearing Protector

AT A FLOOD CONTROL DAM under construction in Oregon, a 48-in. Wemco spiral sand classifier is used as one of the preliminary sizing units. The upper bearing is protected by a sleeve made from a discarded carbide can. In the background and alongside the classifier can be seen the 4 x 12-ft. Symons screen with eight 1/2-in. long chains riding the top deck to help clear the 3/16-in. mesh of the wire cloth used. Sand at this plant is manufactured from coarse aggregates in a

rather complicated sand plant that uses two Symons cone crushers (one standard 48-in. and a 36-in. short-head) and a Hardinge ball mill.

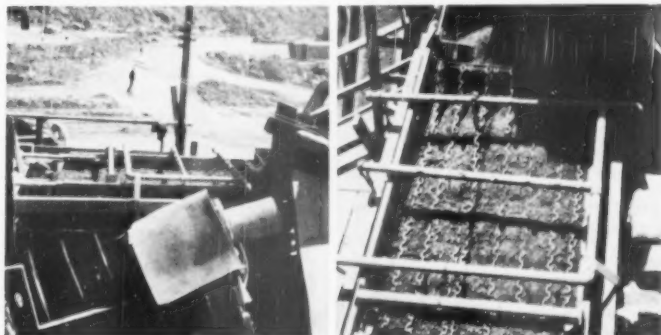
Determining Time Fuse Lengths

THE NATIONAL SAFETY COUNCIL still reports a series of blasting accidents each year that occur as a result of stretching luck too far by

attempting to light too many fuses or attempting a saving by cutting the fuse lengths too drastically. Fuses must be warmed on cool days. Cold fuses will crack open and a jet of flame will escape or the charge will burn instead of exploding, resulting in dangerous fumes. Fuse cutting and crimping operations should always be done at a field work bench where the job can be done with care. Where multiple fuses are lighted consistently several times a day, it is highly advisable to set up a rigid rule governing such work.

Note: Column (1) indicates the various numbers of holes up to 10 which may be lighted at one time by one person provided the length of fuse for each hole agrees with the number of inches shown in column (2), if 40 sec. fuse is used, or in column (4) if 30 sec. fuse is used. For convenience, columns (3) and (5) are included to show the burning rate of 40 sec. and 30 sec. fuses, respectively, in steps of 6 in. each.

Each new supply of safety fuse should be tested for the rate of burning. This is accomplished by cutting off 3 ft. lengths of fuse and timing the burning period. The number of seconds consumed divided by 3 will give the burning rate for one foot of fuse.



Left: End bearing of 48-in. sand classifier in foreground is protected by can; vibrating screen behind classifier uses chains on top deck to keep mesh open. Right: Closeup of screen and lag chains. Note heavy circulating load

New Machinery

**ROCK
PRODUCTS**

Torque Converter Locomotive

PLYMOUTH LOCOMOTIVE WORKS, div. of The Fate-Root-Heath Co., Plymouth, Ohio, has announced a new



Locomotive showing torque converter installation through doors

line of hydraulic torque converter locomotives. The manufacturer lists the following advantages of a unit of this type: all shocks and vibrations are greatly reduced, engine cannot be lugged down or stalled, engine torque is multiplied up to five times at stall, and infinitely variable reduction ratio automatically adjusts to load conditions.

High-Capacity Earthmoving Machines

CATERPILLAR TRACTOR CO., Peoria, Ill., has announced early production of two new high-speed, long haul high-capacity earthmoving machines. These two units, a four-wheel diesel tractor-wagon combination, the DW-20 tractor with W20 wagon, and the DW21 prime mover equipped with the No. 21 scraper, are scheduled for production late this fall.

Both the prime movers have a new model 6-cyl. Caterpillar diesel engine rated at 275-hp. peak capacity at 2000 r.p.m., and 225 hp. at 1900 r.p.m. available at the flywheel. The engine has a 5½" x 6-in. bore and stroke with 743-cu. in. piston dis-

placement. A governor is provided to control low idle speeds and to prevent over-speeding of the engine. All working speeds are controlled by means of a foot throttle.

The DW20 has five forward and one reverse travel speeds. Forward travel speeds range from 2.88 to 26.6 m.p.h. Reverse speed is 3.72 m.p.h. The four-wheel tractor has a wheelbase of 128 in. with the front tread at 88 in. and the rear tread at 84 in. Overall length of the tractor with matched wagon is 45 ft. 8 in., and height is 10 ft. 2 in. The bottom-dump W20 wagon has a struck capacity of 17 cu. yd. and a heaped capacity of 25 cu. yd.

The two-wheel DW21 has five forward speeds which range from 2.16 to 20 m.p.h. Reverse speed is 2.79 m.p.h. Overall length of the tractor-scraper combination is 40 ft. 7 in.; width is 11 ft. 6 in.; height is 10 ft.

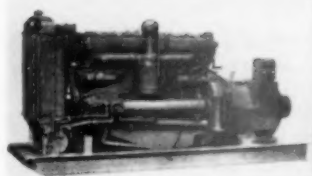


Tractor-scraper combination

7 in. and the wheelbase is 24 ft. 7 in. The wheel tread is 84 in. The cable-controlled No. 21 scraper has a struck capacity of 15 cu. yd., a heaped capacity of 19½ cu. yd. and a 9 ft. 6 in. cut. The struck capacity of the scraper may be increased to 18 cu. yd. and the heaped capacity (based on a 1:1 slope) increased to 22½ cu. yd. by means of 12-in. sideboards.

Generator Set Diesels

MURPHY DIESEL CO., Milwaukee, Wis., has expanded its line of diesel-electric generators to eleven models ranging from 60 to 133 kw. All models comprise heavy-duty Murphy diesel engines and generators engineered as complete integral units and permanently aligned at the factory, the firm states. Design features of the engines include "true" diesel operation, unit fuel injection, four valves per cylinder, extra heavy crankshaft with extra large bearings, oil cooled pistons and others, all of which, it is claimed, contribute to long life and economy and dependability of operation. Sudden load changes are accommodated by a micro-control hy-



Diesel-electric generator set

draulic governor. Voltage is controlled by a rapid acting voltage regulator. The units are said to be suited for paralleled operation of two or more sets with manual or automatic switches. Loads can be equalized or switched as required. It is reported that installation can be either portable or stationary since engine and generator are mounted on a single skid or frame.

New Chain Link Design

BEAUMONT BIRCH CO., Philadelphia, Penn., has announced the "Duratred" link, used in elevator chains, which is designed and made with additional metal on the side of the barrel that makes contact with the sprocket or traction wheel. The new design can be closely compared to the rubber tread on an automobile tire which is made extra heavy on the surface that contacts the road.

Conveyor Mounted on Truck Chassis

GEORGE HAISS MFG. CO., New York, N. Y., div. of Pettibone Mulliken Corp., Chicago, Ill., has introduced a new heavy-duty trough belt piling conveyor for mounting on any truck chassis. The conveyor swings through a 180 deg. arc and piles to any desired height, according to the manufacturer. Lengths of conveyor are available up to 60 ft., with 24-, 30- or 36-in. width belt.



Truck-mounted conveyor shown stockpiling coal

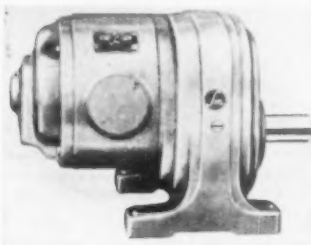


Large bowl wagon with 275-hp. prime mover

NEW MACHINERY

New Electric Motor Design

STERLING ELECTRIC MOTORS, INC., Los Angeles, Calif., has brought out its Slo-Speed geared electric power drives in the "Splash-Proof" design



Splash-proof design electric motor

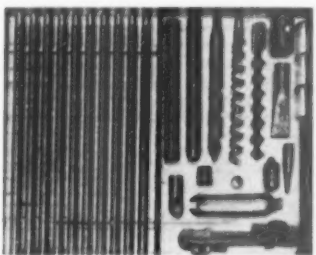
for horizontal floor mounting, which is suited for locations subject to direct streams of water or other liquids, the manufacturer states.

The motors are built with single or double reduction gears, providing speeds from 20 to 780 r.p.m., in horsepower ratings of $\frac{1}{2}$ to 15 inclusive. The end bell design permits free passage of ventilating air through the motor and prevents splashing liquids from reaching the interior of the motor. Seals are incorporated on shaft ends to protect the shafts.

Soil Sampling Kit

ACKER DRILL CO., Scranton, Penn., has brought out a compact and versatile hand-operated soil sampling kit enclosed in a steel case which can be carried in an automobile. The 12 soil and earth sampling tools included in this kit can be used to obtain accurate samples to depths up to 25 ft. in practically all soil and earth formations. The equipment can be used for testing clay deposits, foundation test borings, exploring sand and gravel deposits, agronomic tests, and checking base materials for soil cement stabilization, in addition to many other uses, according to the manufacturer.

Standard tools furnished with the kit include a heat-treated probe for simple exploration, a chopping bit and Iwan post hole auger for starting holes, a closed auger, a Jamaica auger



Equipment kit for sampling soils

and a ship auger for sampling sticky, cohesive material such as loam, clay and kaolin, a split tube sampler and a Chicago thin-wall tube for obtaining undisturbed samples; a dozen sample jars and the necessary drill rods and fittings complete the kit.

Motor Brakes

GENERAL ELECTRIC, Schenectady, N. Y., is offering a line of Tri-Clad motors equipped with Stearns magnetic brakes as unit apparatus. All types of Tri-Clad motors up to 20 hp., 90 lb.-ft. static torque are available with the explosion-proof, electrically operated brake, a product of the Stearns Magnetic Manufacturing Co., Milwaukee, Wis.

The company states that brake combinations are selected to operate at 100 and 150 percent of full-load motor torque for flexibility. A single adjustment nut sets the torque for specific load conditions, thus enabling operation below maximum rated torque whenever possible to conserve brake linings and lengthen brake life. The company states that brake linings are



Open squirrel-cage induction motor with brake mounted on face-type endshield

fabricated of high-friction material for long life without replacement.

All brakes are totally enclosed. As a safety feature, if power fails during operation, the brake will continue to hold because of its spring-set, solenoid-release design, the firm states.

High Power Diesel Engine

DETROIT DIESEL ENGINE DIV., General Motors Corp., Detroit, Mich., has introduced a new compact, lightweight diesel engine designated the "110" because of its 110 cu. in. displacement per cylinder. This is a 6-cylinder 2-cycle unit rated at 275 hp. at 1800 r.p.m., which is attained with a b.m.e.p. of 92 p.s.i. Bore is 5 in. and the stroke 5.6 in.

According to the manufacturer, features of the engine include blower scavenging with a new and efficient gear-driven centrifugal blower which furnishes considerably more air for the cylinders than is needed for combustion. The blower impeller is an aluminum alloy forging 9 in. in diameter and is of the open type with radial vanes.

Other features described by the



Lightweight 6-cylinder diesel engine

manufacturer are unit injectors (one for each cylinder) which pump, meter and atomize the fuel and are removable for inspection or exchange. The cylinder block and head are one-piece castings, both being symmetrical about a vertical plane between the No. 3 and 4 cylinders. This symmetry allows the cylinder head and block to be reversed, which the manufacturer claims gives a choice of rotational directions and makes possible a variety of accessory locations to suit installation requirements.

Forced feed lubrication is provided, with a gear-driven pump delivering 45 g.p.m. at 1800 r.p.m. The oil gallery is a separate tube cast in the cylinder block, eliminating longhole drilling operations. Oil pans have removable bottom cleanout covers. Pistons are triple-cooled with water, oil and air. The engine is available with a torque converter designed specifically for it and installed as an integral unit at the factory for those applications where a fluid drive is advantageous.

Agstone Spreader Unit

HIGHWAY EQUIPMENT CO., INC., Cedar Rapids, Iowa, has brought out a combination commercial fertilizer and agricultural limestone spreader which features a separate engine for driving the distributor discs. The manufacturer claims that this assures full width and uniformity of spread regardless of the speed at which the truck is driven. The truck's drive shaft delivers power through a series of V-belts to the conveyor, which is said to control the volume of material reaching the distributor discs according to the truck speed.



Limestone spreader with independent drive

NEW MACHINERY

New Truck Series Introduced

FEDERAL MOTOR TRUCK CO., Detroit, Mich., has brought out a new series of light and medium duty commercial



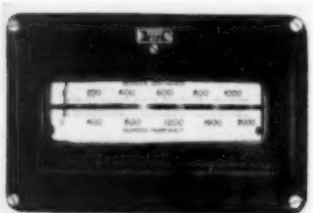
Tractor model of new series of trucks

vehicles known as the "Style Liner." The new line, comprising 10 models, is available in the 1800, 2500, 2900 and 3900 series with gross vehicle weights up to 24,000 lb. and tractor-trailer weights up to 42,000 lb. Eight wheel-base lengths are available ranging from 136 to 250 in. Cab to axle dimensions are from 60½ to 174½ in.

The company states that many accessibility features have been incorporated in the new vehicles. "Swing-lift" fenders permit complete accessibility to the engine, accessories, steering and front brakes. Front fenders are designed to be raised on a concealed hinge by releasing a clasp. A hinged push button panel on the instrument board gives full accessibility to electrically operated gauges. All electrical circuits are individually fused, and fuses are located on a multiple fuse block in the engine compartment on the dash. Wires are colored and circuits plainly marked on the fuse block for quick tracing of wiring, according to the manufacturer.

Indicating Pyrometer

WHEELCO INSTRUMENTS CO., Chicago, Ill., has recently released a compact new indicating pyrometer for flush and surface mounting. It is designed for those applications where size of the heating equipment or space limitations demand the use of a small



Indicating pyrometer for smaller type heating equipment

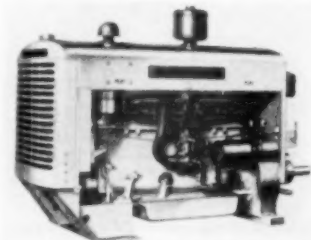
and economical instrument, according to the manufacturer.

The high resistance "edgewise" movement with Alnico V magnet and wide open mirrored scale is fully compensated and enclosed in a dustproof housing, the company states. The front dimension of the unit is 5-in. high by 7½-in. wide.

Interchangeable Power Units

WAUKESHA MOTOR CO., Waukesha, Wis., has introduced a series of portable power units built around three basic sizes, a 4-cyl. and two 6-cyl. engines. These basic sizes are made as diesel, gasoline, butane or natural gas engines, and carry approximately the same output ratings, size for size, whether diesel or carbureted fuels are employed, according to the manufacturer.

The three natural gas, butane and gasoline power units which are counterparts of the diesel power units, and which have interchangeable mountings, may be supplied with either gas, gasoline or combination gas-gasoline carburetors, and being high compression



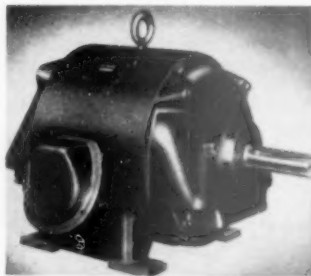
Six-cylinder portable gas or butane power unit interchangeable with diesel power unit

sion overhead valve engines, it is said there is no other change than carburetor and timing adjustment needed when switching from gas to gasoline operation.

The identical mounting dimensions of each size permit either a diesel, gasoline or natural gas power plant to be installed in a machine with no alteration of the mounting base or drive. Thus the manufacturer states that an equipment owner may switch complete units in the field to whichever type of power plant is needed to utilize the most easily obtainable and most economical fuel in the locality of operation.

New Splash-Proof Motors

WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Penn., has introduced splash-proof induction motors designed for constant speed applications both indoors and outdoors. They are fully protected from dripping or splashing liquids by solid rolled-steel frames and baffles in the end brackets, the company states. These motors are also



Splash-proof induction motor for constant speed operation

equipped with prelubricated bearings. No lubrication is required for the life of the bearing.

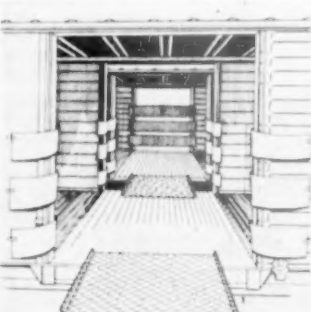
The motors are available in horsepower ratings of 7½ to 100, for voltages of 208, 220, 440, 550, and 2300.

Polarized Safety Eyeglasses

THE POLALITE CORP., Whitestone, L. I., N. Y., has announced a new line of polarized eyeglasses to fill the need for a custom-made safety glass suitable for everyday wear. The lenses are made of glass with a plastic safety interlayer that imparts the same feature found in present day automobile windshields, the manufacturer says. Polarization is obtained from a continuous crystalline polarizing layer included within the safety interlayer. Polarization reduces glare and improves fine detail and colors.

Retaining Strips for Box Cars

SIGNORE STEEL STRAPPING CO., Chicago, Ill., has developed Duplex Retaining Strips for protecting shipments of bagged materials in box cars. The retaining strips prevent side-shifting of load, protect against car doorway damage and reduce damage, according to the manufacturer. They are made of heavy kraft paper reinforced at top and bottom with steel strapping.



Retaining strips prevent damage in shipping of bagged materials

New Heavy-Duty Diesel Engine

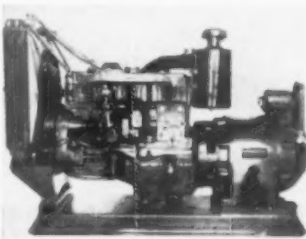
INGERSOLL-RAND Co., Phillipsburg, N. J., has brought out a new type of diesel engine in the 195- to 375-hp. range. According to the manufacturer, the TS diesel can be made portable easily, but it is not the automotive-type; it is small in size, light in weight and well balanced. It is a four-cycle, 7-in. bore, 8½-in. stroke, single-acting engine with a weight of about 30 lb. per hp. and a fuel consumption of 0.40 lb. per hp.-hr.

Cylinders of the engine are provided with replaceable, wet-type liners and individual heads with overhead valves and intake and exhaust valve-seat inserts. Individual fuel injection pumps serve each cylinder, with two single-hole, non-clogging nozzles per cylinder. The engine is full-pressure lubricated throughout, the manufacturer states, and is equipped with a gear-driven mechanical supercharger which supplies air for increasing initial pressure in the cylinders and for scavenging during the latter part of the exhaust stroke.

Normal starting is by 250-p.s.i. air admitted to all cylinders in turn through a starting-air distributor. Other methods of starting can be fur-

continuous service applications where the unit is the primary source of power. Instant starting and high availability characteristics claimed are said to make them excellent standby or emergency sources of power.

Optional equipment offered by the company for the various generator units includes automatic overspeed shut-down control; automatic high temperature and low lubricating oil pressure shut-down; complete marine-type or radiator-type cooling systems; hydraulic governor; water-cooled exhaust manifold, and generator mounted package control unit. Special generator voltages and kw. ratings are also available. The unit consists of the engine direct-connected to a single bearing generator, the engine and



Standard diesel-powered electric generator unit

generator being mounted on a steel subbase.

Standard diesel generator units offered by Cummins are of the alternating current type, 50-60 cycle, 3-phase 3-wire, 3-phase 4-wire. All kilowatt ratings given are for continuous duty operation. At full load of the generator, the engine is said to deliver from 68 to 76 percent of the maximum horsepower available at that speed, depending upon the kilowatt size of the generator and the engine used.

Air-Operated Control Drive

BAILEY METER Co., Cleveland, Ohio, is now making a characterized control drive which can be "tuned" to the requirements of a special application. The manufacturer states that its completely enclosed air-operated drive makes it possible to parallel characteristics of a driven device with characteristics of other equipment, thereby securing a unified system.

The drive consists of a double-acting air cylinder, a positioning relay and a manual operating wheel or lever. The positioning relay incorporates a cam whose shape determines the relation of control drive position to control loading pressure. Three cams are included with each drive and may be used interchangeably to obtain positions which are proportional to the



"Characterized" control drive

first power (straight line), square or square root of the control loading pressure.

The drive is claimed to be extremely accurate, requiring only 0.10 p.s.i. change in control loading pressure to deliver full supply pressure to the piston in the air cylinder. The entire unit is enclosed in a steel box. The manufacturer states that the control is ideal for outdoor power plants, cement mills and other process plants.

Permanent Belt Conveyors

BARBER-GREENE Co., Aurora, Ill., is producing the "Redi-Fab Series" of permanent belt conveyors, available in 18-in., 24-in., and 30-in. widths, 49 lengths, and with numerous other accessories.

The series includes five new drives for greater flexibility. The drives include partial reductions for the user who wishes to drive the conveyor from a power take-off shaft of some other piece of equipment such as a crusher. The new series of belt conveyors also includes three types of feeders: reciprocating, apron and belt. All three are driven from the foot-shaft of the conveyor.



Typical installation of permanent belt conveyor



Diesel engine providing 195 to 375 hp. at 900 to 1000 r.p.m.

nished, the manufacturer advises. The engine is available in 6 or 8 in-line cylinder designs, capable of delivering 195 to 375 hp. at 900 to 1000 r.p.m.

Generator Units

CUMMINS ENGINE Co., Inc., Columbus, Ind., has announced production of a standard commercial line of Cummins diesel-powered electric generator units. Sixty-cycle units are available in 40-, 50-, 60-, 75-, 100-, 125-, 200- and 250-kilowatt ratings. Similar units are available for 50-cycle operation at a slight de-rating in kw. capacity.

The company states that these diesel generator units are designed for



General view of Detroit dam operation showing aggregates facilities, center, and dam base structure, right

Cooling Aggregates and Cement for Detroit Dam

Sand and cement as well as coarse aggregates cooled for project in Oregon to hold concrete temperatures within close limits. Crushed stone plant has 600 t.p.h. capacity including manufactured sand

THE DETROIT DAM is located 50 miles east of Salem, Oregon, and is being built across the North Santiam river, one of the larger tributaries of the Willamette river. The dam is a concrete structure involving the placement of 1,500,000 cu. yd. of concrete. The work is a part of the Willamette project which in turn is a part of the Columbia and Snake river developments. This great project in its entirety contemplates some 238 self-liquidating projects which includes irrigation of some 5,000,000 acres of new land, flood control protection that will save tens of millions of dollars annually, and the development of some 56 billion kw.-hr. annually. Secondary and more intangible benefits stem from recreational facilities, more extensive deep water navigation of the Columbia river, and fish and wildlife conservation. Grand Coulee, McNary, Bonneville, Cottage Grove, Fern Ridge, and Dorena dams are all a part of this vast project. McNary dam is still under construction on the Columbia river but the other dams are completed. Lookout Point dam is also

By **WALTER B. LENHART**

a part; it is in the early construction stages.

Detroit dam is being built under the direction of the U. S. Army Corps of Engineers with Consolidated Builders, Inc., the prime contractor. The Henry J. Kaiser interests are major affiliates of Consolidated Builders, Inc. The job is scheduled to be completed by the fall of 1953. C.B.I.'s contract amounts to \$28,000,000, which covers the principal structures exclusive of power house and related installations. The total cost of the project is estimated to be \$70,000,000.

First Concrete Pouring

On August 5 the first bucket of concrete was poured amid appropriate and interesting ceremonies. Placement of the first 8-cu. yd. bucket of concrete was by Douglas McKay, governor of Oregon. Preceding the actual placement, short talks were made by Col. O. E. Walsh, regional head of the

Corps of Engineers, Col. D. S. Burns, district engineer of the Corps, Albert Bauer, general manager of Consolidated Builders, Inc., and Governor McKay. C. C. Davis, resident engineer at Detroit dam, acted as master of ceremonies. "Woody" Burgess, concrete engineer, was at the microphone and gave spectators a running account of the pour.

The programs being carried out on the North Santiam river should be of considerable interest to rock products operators. The entire project is in a majestic setting of steep, timbered mountains. Practically all of the aggregate processing, quarry, and concrete producing facilities are on the south side of the steep-walled canyon with Highway 222 paralleling the north rim. The highway is at such elevation that practically the entire project can be seen by motorists without the need for securing a visitor's pass. For the guidance of visitors, the engineers have prepared a mimeographed brochure which is captioned "Information for Roadside Superintendents." In it are described the high-

lights of the aggregate producing and concrete pouring operations that seem to cling to the walls of the opposite sides of the gorge. When this project is completed it will probably be one of the most beautiful of its kind in America and will vie with Hoover dam on the Colorado as a tourist attraction.

Aside from these layman-type of interests, the job has brought development of new techniques and processing that may indicate a trend in the future processing of aggregate for large structures.

Temperature Specifications for Aggregates

It is the first project involving major concrete placement where all the aggregates including the sand will be cooled. In previous issues of *Rock Products* we have described the aggregate cooling practices at Bull Shoals, Bugg's Island and other dam projects. At these jobs, only the coarser aggregates were cooled by immersion in cold water. However, at Detroit dam, due to the rigid specifications that call for concrete to be placed at 40 deg. F. minimum and 50 deg. F. maximum, complete control of the temperature of all aggregate and of the portland cement is necessary. The 50 deg. top limit is allowed one hour after placement.*

The intent of the quite extensive aggregate cooling equipment is to have the temperature of the crushed stone at the mixer be 38 deg. F., the sand 50 deg. F., and the portland

cement 60 deg. F. The Pine Flat dam on the Kings river near Fresno, Calif., and the Lookout Point dam in Oregon have similar temperature specifications.

With the aggregate and cement temperatures in this range, the resulting concrete will be in the 42 to 44 deg. range, well below the maximum specifications. This range in temperature will necessarily vary with changes in the weights of the aggregates, cement, and water used for the different types of concrete poured.

Temperature records for the area over a period of many years indicate that concrete can probably be placed practically the year around. Pouring must stop when ambient temperatures fall below 32 deg. F. When portland cement is delivered to the cooling system at a temperature of 150 deg. F., sand at a temperature of 70 deg. F., and coarse aggregates at 65 deg. F., the cooling plant is expected to deliver materials at the specified temperatures. However, stone and sand temperatures can be governed somewhat by the weather conditions.

Cooling Plant

By referring to Fig. 1, the operation sequence for cooling of the coarser aggregates can be noted. In this connection it is important to note that sufficient aggregate cooling capacity must be available to pour continuously at a maximum rate of 250 cu. yd. per hr. It has been these operator's observations that cold air quenching at Detroit dam to cool aggregate is not feasible economically. The engineers for Consolidated Builders, Inc., under the direction of H. H. Roberts, chief engineer, have designed a cooling plant that is expected to meet all needs. However, these engineers and the editors of *Rock Products* wish to point out here that some of the mechanical features relating to sand and cement cooling are new and untried, and it is possible that many "bugs" will have to be worked out of the system.

The cooling of the sand and of the

portland cement will be by means of specially designed screw-type conveyors with cold water flowing countercurrent through the hollow steel flights. For the sand there are four banks of four conveyors to each bank, and one of these banks serves each of the two feed tanks. In one bank (as an illustration) the warm sand will flow into the top flight and be conveyed to its end where it will be dropped into the flight below; there the sand will flow in the opposite direction. The sand will go through the third and fourth flights to final discharge in a similar manner. There is one bank of three conveyor flights for cooling the portland cement. The time required to cool nominal coarse aggregate is between 28 to 35 min. Cooling the portland cement below 60 deg. will not be attempted as 60 deg. is the average dew point for the vicinity.

For cooling the coarse aggregates there are five immersion tanks, each holding 120 cu. yd.—one silo for each size of aggregate, plus one for a spare. Time of immersion and of circulation of the 35 deg. F. water will depend on size of stone and temperature of the aggregates. The immersion time can be preset and is under the control of the mixer operator. If operated on a preset basis, flow of cold water ceases automatically and the tanks also drain automatically. The cooled aggregate can then be discharged to the reclaiming belt that delivers the damp material to two dewatering screens, after which the material goes to the mixing plant on a belt conveyor. The dewatering screens are designed to give an aggregate with a constant surface moisture content and to remove any unwanted fines that have accumulated due to interplant breakage of the sized aggregates.

Ahead of each of the two banks of sand coolers is a cone-bottomed steel silo, each holding 70 cu. yd. of material. Each silo unloads to its bank of coolers by a Jeffrey vibrating feeder. The cooled sand falls to a 24-in. belt conveyor that operates in a gallery extending to the batching bins. A 36-in.

*The approximate temperature of the concrete can be calculated from temperatures of the ingredients by the use of some formulas such as:

$$T = \frac{S(T_s W_s + T_w W_w) + T_c W_c + T_m W_m}{S(W_s + W_w) + W_c + W_m}$$

where W_s is the weight of the surface dry aggregate

W_w weight of cement

W_m weight of free moisture in aggregate

W_c weight of mixing water

T_s temperature of the surface dry aggregate

T_c temperature of the cement

T_m temperature of free moisture in aggregate

T_w temperature of mixing water

S assumed specific heat of the dry materials, 0.20

T the temperature of the concrete



Tom M. Price, consulting engineer for Kaiser interests, left, and Jack Murry, industrial relations



First pour for Detroit dam

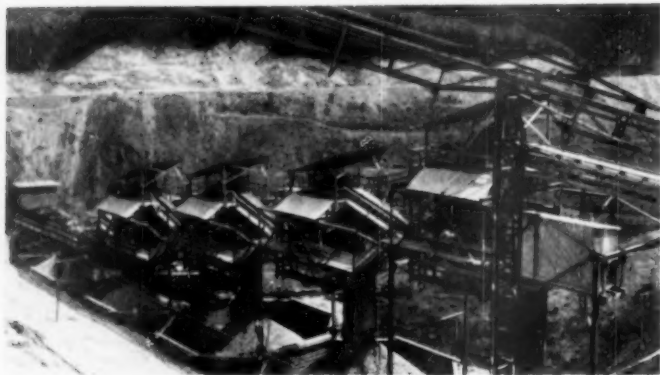


"Woody" Burgess, concrete engineer

AGGREGATES



General view of aggregates plant at Detroit dam



Aggregate bins with vibrating screens mounted over them

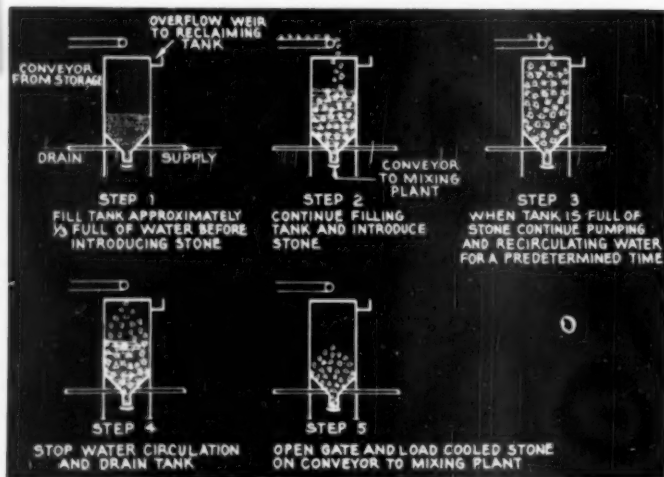


Fig. 1: Operation sequence for cooling graded coarse stone

belt for the coarse aggregate also operates in this gallery.

The cement used is from the Permanente Cement Co.'s plant near San Jose, Calif. The cement is hauled close to the site on the Southern Pacific railroad from Portland, after which the cars use the railroad system of the contractors. The cars are unloaded to two steel silos located near the bottom of the canyon. For this unloading two type "C" Fuller-Kinyon remote control unloaders are used. The two silos hold 5000 bbl. each. An 8-in. Fluxo cement pump feeds the 5000 bbl. storage silo at the cooling plant through an 8-in. pipe line that is partially supported by a steel cable. Cement delivery involves a vertical lift of about 410 ft. and a horizontal flow of around 900 ft.

The cement in the hoppers silo at the cooling plant is delivered to its cooling system by a rotary valve that serves an F-K airslide, which in turn serves the conveyor-cooler. The cooled cement is delivered to the mixing plant by another Fuller airslide that operates in the same gallery as the two previously mentioned sand and aggregate conveyors. Figs. 2 and 3 will give some of the details of this installation. The sand and cement coolers were supplied by J. D. Christian Engineers.

For supplying the chilled water a 700-ton refrigeration plant developed by the engineering staff of Consolidated Builders, Inc. is operated. It uses Frick conventional ammonia compressors, condensers, evaporators, etc.

Additional cooling of the placed concrete will be accomplished by use of cooling pipes immersed in the concrete. This practice, however, is expected to be confined to the lower sections of the dam.

Aggregate Plant Site

Because of total lack of a conventionally suitable site, the aggregate plant is erected along the side of the gorge above the damsite, and by its very location has to use belt conveyors to a great extent. These range in widths from 24-48 in. The two longest units are conveyors No. 3 and 17. They are both about 700 ft. center to center. The former is a 36-in. belt and reclaims the minus 6-in. from the surge pile. The second long belt is a part of the conveyor assembly serving the cooling plant. All belts were supplied by Goodall Rubber Co., Philadelphia, Penn. The idlers for the extensive conveyor system are Robins and of the type that can be greased from one side. Conveyor No. 3 is cable-suspended across Cumley creek just above the dam. The belts are all driven by individual motors through gear reduction units.

Aggregate Sizes

Similar to practice at many of the federal-sponsored dam construction

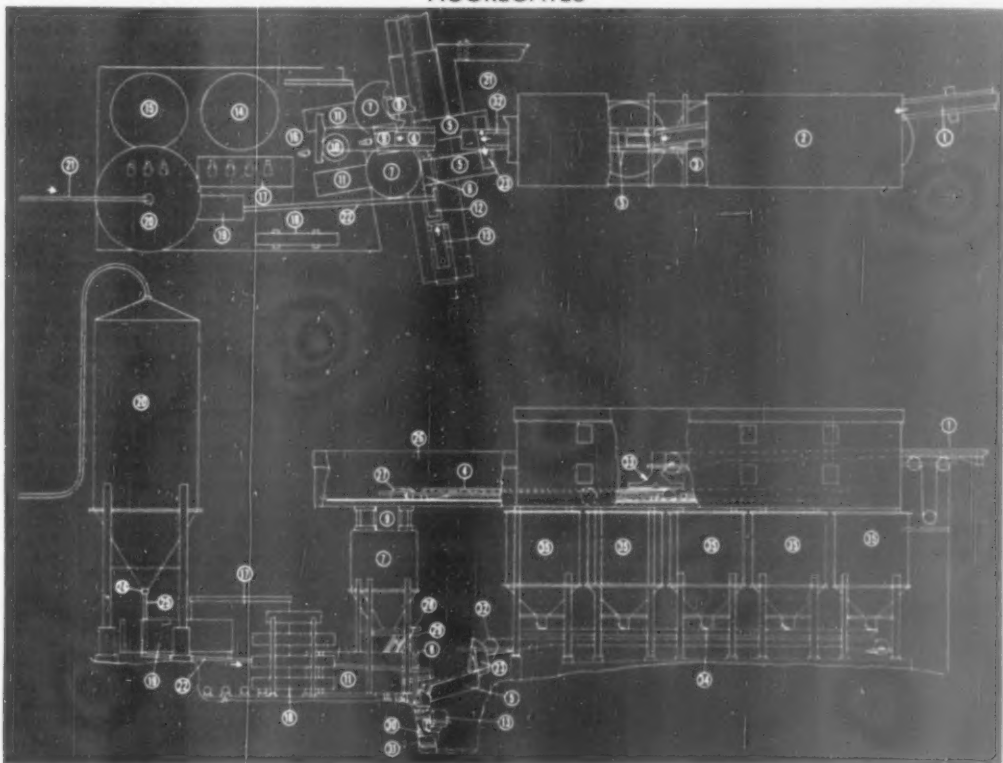


Fig. 2: Plan and elevation of the cooling plant for Detroit dam project. (1) 36-in. conveyor from sand and aggregate storage. (2) Cooling tank housing. (3) Control house. (4) 36-in. shuttle conveyor. (5) Dewatering screens. (6) Chute. (7) 70-cu. yd. sand tank. (8) Sand chute. (9) Splitter chute. (10) 2000-gal. surge tank. (11) Sand cooler. (12) 24-in. sand conveyor. (13) 36-in. aggregate conveyor. (14) 30,000-gal. chilled water storage tank. (15) 30,000 gal. chilled water return tank. (16) 450-g.p.m. pump. (17) Power center house—800-g.p.m. pumps. (18) Water cooler. (19) Cement cooler. (20) 5000-bbl. cement silo. (21) 8-in. cement line from unloading silos, 250-300 bbl. per hr. (22) Cement airstide. (23) Screen feed chutes. (24) Rotary valve. (25) Cement chute and by-pass. (26) Shuttle conveyor housing. (27) Drive for shuttle conveyor. (28) Sand feeders. (29) Splitter gates. (30) Sand chutes to conveyor. (31) 24-in. sand conveyor drive. (32) 36-in. conveyor. (33) Two-way chute to shuttle conveyor. (34) Air-operated roller gates. (35) Coarse aggregate cooling tanks.

jobs, four sizes of coarse aggregate are made. Here the diorite rock is screened dry to the following sizes: plus 3-in. minus 6-in.; plus 1½-in. minus 3-in.; plus ¾-in. minus 1½-in.; and plus ¾-in. minus ¾-in. For preparing these sizes there are eight Allis-Chalmers screens mounted in a line over octagonal wood bins of laminated construction. All screens are single decked. Each bin holds 2500 tons. For the coarse size of rock two 5- x 12-ft. screens are used. The 1½-in. and ¾-in. crushed stone each use two 5- x 10-ft. screens, and the ¾-in. stone is processed on 5- x 14-ft. screens. At the time the bins were built, green lumber had to be used, so provisions were made to keep the screens in proper alignment. This was done by mounting the screens on steel assemblies which could be jacked up later and shimmed as shrinkage of the green lumber took place. Lateral displacements were adjusted by steel cables. Since the bins were constructed, the vertical shrinkage has been

about 12 in. In the general layout of these bins, provisions have been made to recrush any of the larger sizes of stone and to return them to the screening circuit. The final crushing plant consists of a 5½-ft. Symons short-head cone crusher with a fine crushing bowl, and two 4¼-ft. Symons standard cone crushers with medium bowls.

World's Largest Jaw Crusher

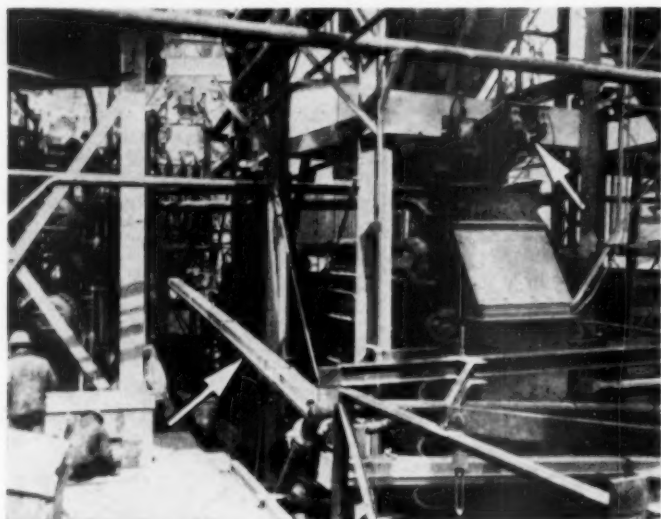
The primary crusher is a Birdshorn-Buchanan 66- x 84-in. jaw crusher, the largest deep-frame jaw crusher in the world. In the December, 1949, issue of *ROCK PRODUCTS* we described this crusher in detail. The crusher is set to discharge a 14-in. product, and at that setting has a capacity of 800 t.p.h. The main bearings of this large crusher are water-cooled, are of babbit construction, and are replaceable. Other grease lubrication is by the Farval Corp. system, so designed that all bearings get adequate lubrication from centrally located lubrica-

tion points. The cheek plates (1½ in.) and other manganese steel pieces were supplied by Taylor-Wharton Iron and Steel Co. The jaw crusher is driven through 20 Gates V-belts by a 300-hp. motor at 89 r.p.m. Mounting this 275-ton crushing unit on the precipitous sides of the site chosen was no small feat. The jaw opening of this large crusher is sufficient to receive one or more loads of rock from the fleet of 8-cu. yd. Euclid rear-dump trucks that serve the unit. The jaws are more than large enough to take any piece of rock that the 5-cu. yd. Bucyrus-Erie 120-B electric shovel can handle in the quarry.

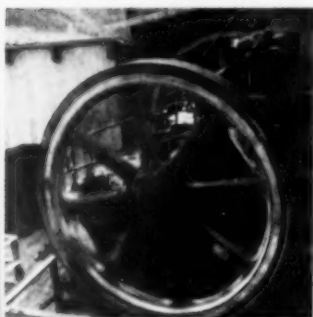
Quarry Location

The site chosen for the quarry is at the apex of a mountain peak adjacent to the damsite. A series of switch-back roads leads to the primary crusher. The rock is a hard diorite which in the larger sizes tends to break so as to yield rock of specification requirements easily. Other aggregates in the

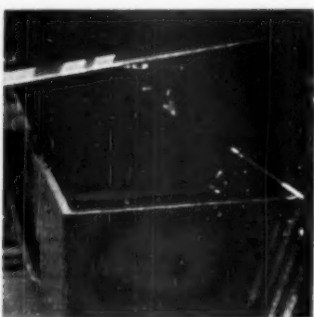
AGGREGATES



Cooling section. Arrow, left, indicates airslide in cement cooling section. Arrow, right, points out feeder to sand coolers



Fly wheel on the deep frame crusher weigh 25,000 lb.



One of the vibrating screens used for final sizing

vicinity of Detroit dam were held to be unsuitable because they were considered reactive. This rock is a fine grained, medium dark colored diorite of magmatic origin and is hard and tough with good L. A. rattle ratings.

Coyote system of blasting is utilized at Detroit, augmented by snake holes drilled by a battery of Chicago Pneumatic wagon drills and jackhammer-type drills. Air for all purposes on the job is supplied by two stationary plants of 6400 c.f.m. capacity augmented by four portable units. (All compressors are Chicago Pneumatic.) Stripping was done hydraulically prior to quarry operations by means of hydraulic giants, and the overburden sluiced into the drainage system.

The 10-in. stone from the Birdsboro-Buchanan jaw crusher falls to a 48-in. belt that serves two Allis-Chalmers dry scalper vibrating screens. The top deck is 6-in. wire and the lower deck

is $\frac{3}{4}$ -in. The oversize falls to a 30-in. A-C gyratory reduction crusher. All minus 6-in. stone can go to the 50,000 ton total capacity surge pile; however, if the stone is dirty from seam-sources inherent in the quarry, the minus $\frac{3}{4}$ -in. material from the lower deck can be by-passed and rejected over a short stub conveyor. From a casual inspection of the quarry faces, the amount of material in the seams is not large. The A-C gyratory reduces the rock to minus 6-in., and it joins the throughs from the A-C scalpers on the offbearing belt to the surge pile. Reclaiming to the 56-in. belt under the surge pile is by a Jeffrey vibrating feeder. The size of the surge pile is limited by the nature of the terrain.

Sand Manufacturing

All sand for the Detroit dam is manufactured from the diorite raw materials and provisions are made so

that several sizes of coarser material can be drawn from the laminated wood bins and eventually go to the sand grinding assembly by belt conveyors; however, conventional practice is to send the minus $\frac{3}{4}$ -in. material.

The sand manufacturing plant is located near the top of the aggregate processing plant. The material going to this plant first passes over a wet 5- x 10-ft. Stephens-Adamson vibrating screen that has 4-mesh wire on it. The oversize is belt conveyed to the 8- x 12-ft. peripheral discharge Marcy rod mill. This unit receives feed from both ends and discharges through ports in the periphery of the drum. The pulp from the rod mill joins the undersize from the S-A preliminary screen and goes to a Dorco bowl classifier by means of a launder. This unit has a 19-ft. bowl and an 8- x 37-ft. 6-in. rake. At the upper end of the rakes the bottom section of the Dorco dewaterer has been extended upwards about two feet so that a reasonably large bulk of sand is above the top rake at all times. This rake has been perforated with a slot to facilitate drainage. Having a relatively large volume of sand above the upper rake permits more drainage time which in turn means a drier sand.

Near the rod mill is a 5- x 25-ft. 6-in. Dorco rake classifier that can be thrown into the production line should sand gradation require its use. At time of inspection it was not being used. The manufactured sand is deficient in the extreme finer sizes and later steps may be taken to recover this size of material from the washing plant and add it to the production. Enough sand bins are ahead of the cooling plant to provide sand drainage for at least 72 hr. Four bins of 2500-ton capacity each are provided. The aggregate plant can produce 600 t.p.h. of which 125 tons is sand.

Batching Plant

The batching plant features Johnson automatic batchers that serve four 4-cu. yd. Koehring full-tilting mixers. It is planned to use Type IV cement during the summer months and during the cooler season to use Type II.* A 2.4 to 2.5 bag per cu. yd. mix is the aim for the interior or mass concrete. A 4-bag mix will be

*Type II cement is the type used for most of the larger construction jobs. It is characterized by a low C_A and high C_AF content. It has low heat generating properties with correspondingly smaller volume changes. It also has great resistance to sulfate (alkali) solutions. It is a finely ground cement and has low bleeding properties along with good workability and low permeability.

Type IV cement generates less heat than any other cement and does so at a slower rate. It was developed to help reduce cracking resulting from high temperature rises. Concrete made from this cement has high sulfate resistance properties and is slower to develop full strength, although it eventually reaches the strengths desired. Longer curing time is required and more care must be exercised when this cement is used in regard to freezing conditions, early removal of forms, and damage from accidental causes.

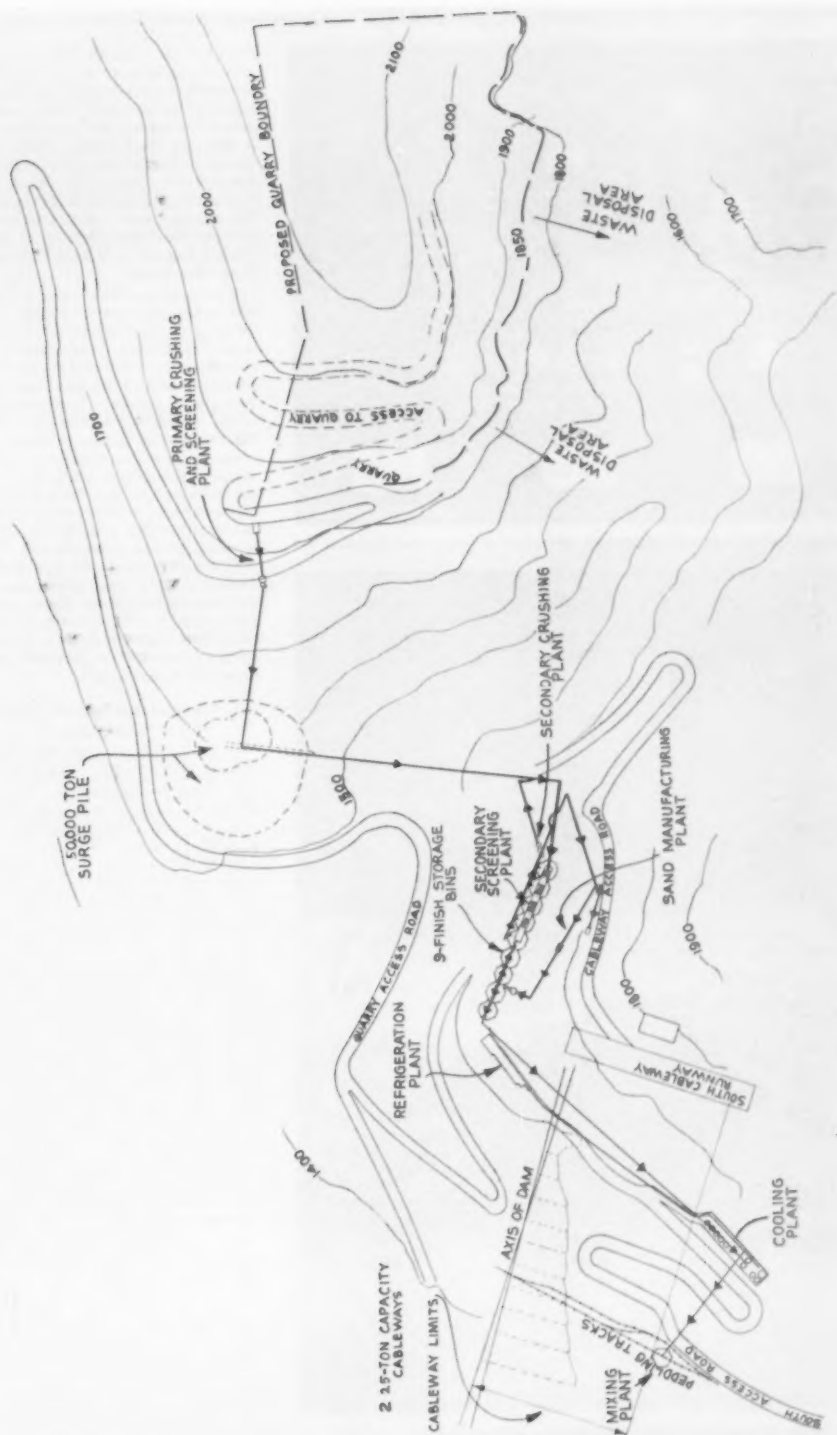


Fig. 3. Topographical features of damite showing location of quarry, and crushing and cooling plants

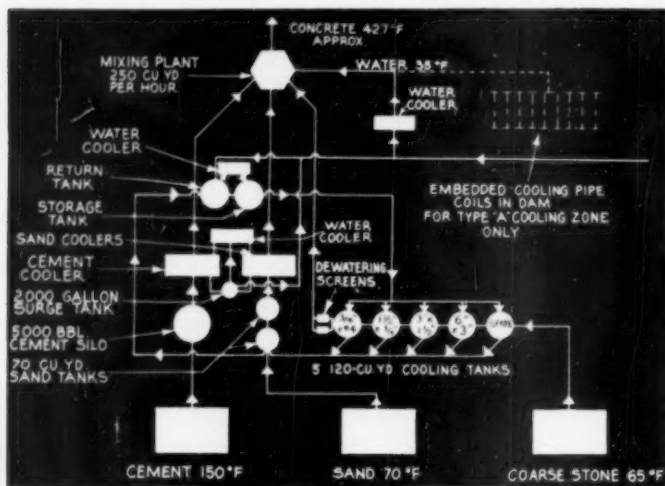


Fig. 4: Schematic plan of aggregate and cement cooling and routing to batching plant



Two cement silos alongside railroad are filled and emptied by pumps. Pipe line from the pump that empties the silos crosses the canyon, rising to left, foreground



At the quarry, rock is loaded for haulage to primary crusher

used for the face. No additives or pozzolanic materials are added. Double-strength Protex is used as the air-entraining agent, and before use it is diluted with water 1:1. This is said to be the first time that double-strength Protex has been used in this manner on mass concrete. A 3 to 6 percent air content is aimed at for the minus 1½-in. aggregate concrete, but for the interior or mass concrete the air content will be held nearer the 6 percent figure.

The Corps of Engineers has a division laboratory at Troutdale, Oregon. This is a short distance from Portland. The district laboratory is under the direction of Harold Stuart. Concrete pozzolanic studies, and studies relating to causes of cracking in concrete, are being carried on at this laboratory, so minor changes in the concrete specifications may later develop. Adequate facilities for testing all materials from the aggregate to the finished concrete are available at the construction site. Woody Burgess is the concrete technician at Detroit.

The contractors plan on a sustained 250 cu. yd. per hour placement schedule, or approximately 2000 cu. yd. per 8-hr. day. The batchers have a rated capacity of 320 cu. yd. per hr. By the spring of 1951 it is expected that 1000 men will be employed.

Transportation of Mixed Concrete

Two "Travelift" cableways span the 1950-ft. wide canyon with four traveling towers supporting the cables. From the Johnson batching plant the concrete will discharge to 8-cu. yd. Blaw-Knox bottom-dump buckets. Flat cars carrying three buckets each operate over the peddling track, shuttling to and from the mixing plant and cableway hook-up points. Blaw-Knox steel forms will be used, which is said to be an innovation in the Northwest. Each cableway has a capacity of 25 tons. The buckets are divided vertically by a steel plate and each compartment can be dumped individually. This results in less upward spring of the bucket while suspended from the sky-line when its 12-ton load is discharged. This is a decided safety precaution, though the design of the bucket can have other concrete placement advantages. The gates in the bottom of the bucket open and shut through self-contained and remote control mechanisms.

For placing concrete not easily reached by the sky-line assembly, a Pumperete unit has been provided. This is said to be one of the largest units of its kind and is provided with an oversized steel hopper to facilitate loading. Under several of the conveyor galleries used Army trusses have been adapted to advantage. Their use and advantages can be gauged from the illustrations shown.

AGGREGATES

Personnel

Col. O. E. Walsh is head of the regional division of the U. S. Corps of Engineers, with headquarters in the Pittock Building, Portland, Ore. Other Corps of Engineer personnel include Col. D. S. Burns, district engineer; C. C. Davis, resident engineer; S. S. Overholser, assistant resident engineer; C. W. Beck, operations engineer; H. W. Rutherford, engineering section; Woodrow L. Burgess, concrete engineer; Ken Ramsey, general dam construction engineer; E. N. Ferguson, construction superintendent for related work; and D. E. Loughram, geologist. W. O. Silverthorn and D. M. Polivaka are heads of the technical information branch with offices in Portland.

For the Consolidated Builders, Inc., Albert Bauer is general manager; R. A. Hoffman, general superintendent; H. H. Roberts, chief engineer; Eldon Lents, office manager; K. A. Nielson, purchasing agent; Roy Kendler, paymaster; J. O. Murry, personnel manager; B. W. Provost, excavations superintendent; O. M. Mikkelsen, master mechanic; George Humphrey, rigging superintendent; Ray Steiner, mixing and cooling plant superintendent; Ed Carpenter, aggregate processing plant superintendent; Lee Pinkston, quarry superintendent; J. McNeely, carpenter superintendent; Floyd Jones, electrical superintendent, and Ray Walker, warehouse superintendent. Tom M. Price is consulting engineer. Mr. Price was in charge of the aggregate production and railroads at Hoover (Boulder) dam at the time of its construction in the mid 30's.

We wish to thank both organizations at Detroit, and particularly Chief Engineer H. H. Roberts for his cooperation. Mr. Roberts was chief engineer at the Bull Shoals dam job. Thanks are due Woody Burgess and C. C. Davis of the Corps of Engineers for their helpfulness, and to "Tex" Allen, structural engineer for the contractors, for his helpful guidance through the entire operation.

The Detroit dam as planned will serve as a multiple-purpose reservoir. During late fall and winter, water levels behind the dam will be kept low to provide storm storage for flash flood waters. After danger of floods has ceased, the water level will be kept at a high point so as to provide a steady source of water for power, irrigation, navigation in the downstream areas, fish life benefits, and for stream pollution abatements.

A few miles downstream from the Detroit dam will be built the Big Cliff regulation dam and reservoir. The purpose of this dam will be to conserve the water released by the upper dam during peak loading periods of the power producing facilities. It is a smaller structure than the Detroit dam. The Detroit dam will have a capacity of 100,000 kw. and the Big Cliff 18,000 kw.



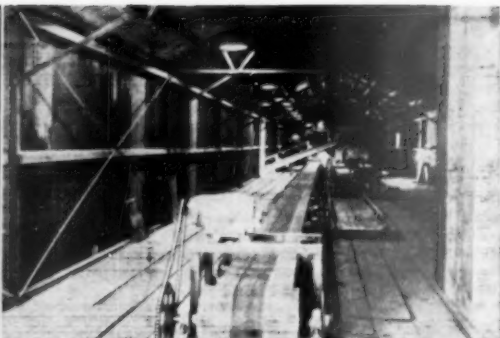
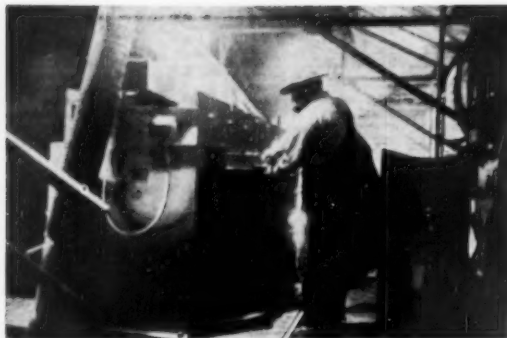
Gallery houses two belt conveyors, one for sand and one for aggregate, as well as an airstide for delivery of portland cement to batching plant. Surplus Army trusses are used as part of the main supporting assembly for the gallery



Final reduction crushers are located at the high end of the lower belts



Belt conveyor serving surge pile is suspended from steel cables; it is about 700 ft. long



Left: Workman is shown in the process of changing a screen on one of the gyratory screens; removable housing for screen can be seen at right.
Right: Three parallel belt conveyors are used to transfer sized material to the six steel silos.

PROCESSING PERLITE ORE FOR CONTROLLED EXPANSION

COMBINED METALS REDUCTION Co., with headquarters in Salt Lake City, Utah, is one of the largest producers of lead and zinc in the United States. Its mine and mill at Caselton, Nev., account for most of the lead, zinc and silver that the state of Nevada produces. Early in 1949 Combined Metals organized the Panacalite Division. During March, 1949, this division placed in operation a new plant designed to crush and size crude perlite and to ship that commodity to commercial expanding plants throughout the country. Within a year's time shipments from the Caselton plant have grown until the company is the largest recorded shipper of crude perlite in the United States. This growth can be traced to two important factors: first, excellent raw materials that can be selected from one of the company's three large deposits; secondly, the construction of a processing plant that has been well engineered and which can supply the buyer with exactly the size and type of raw perlite that best suits his needs.

Since perlite has occupied much of the limelight in the construction field, **ROCK PRODUCTS** has published from time to time considerable data on the expanding or "popping" plants and information on the character of the expanded material itself, but very little has been published on the preparation of the raw material for the simple reason that most of the crude processing plants that have been pioneering this industry were very small and still in the experimental stages. The Caselton plant is a marked exception to this generalization.

Quarry Location

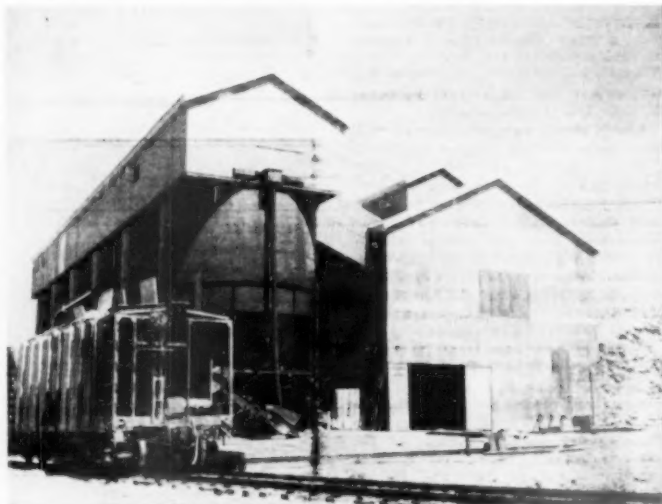
Caselton, Nev., is about six miles from Pioche, and the latter mining

**Combined
Metals Reduc-
tion Co., at Cas-
elton, Nev., pro-
duces five closely-
sized products for
shipment to expand-
ing plants. Well-
designed plant
features new-
type gyrating
screens**

By **WALTER B. LENHART**

community is in the east central part of Nevada near the Nevada-Utah state line. The area is served by the Union Pacific railroad which connects Salt Lake City with Los Angeles. The area is desert in character. Winters are cold, but snowfall is relatively light and operations are carried on throughout the winter months. Caselton is 6000 ft. above sea level.

The Combined Metals Reduction Co. does not own or operate any expanding plants, but it does sell such plants. These are manufactured by O. J. Scherer Co. which has headquarters at the old Basic Magnesium, Inc., plant at Henderson, Nev., near Las Vegas. Combined Metals assists wher-



View of the perlite grading plant, showing the compact arrangement

ever possible in the breaking in and operation of the popping plants. It services them as well and is repaid on a royalty basis. Expanding plants, under this arrangement, have been built in Los Angeles, Richmond, Calif., Kansas City, Oklahoma City, Dallas, Pittsburgh and elsewhere. The expanded perlite from these plants is marketed under the trade name of Panacalite. However, a considerable portion of the Caselton production has been going to expanding plants other than those supplied through or by Combined Metals.

Perlite Deposits

The company has three perlite deposits: the Fairview mine, the Hollinger, and the Giant. The latter is $4\frac{1}{2}$ miles from Caliente, Nev., on the Union Pacific railroad. The Hollinger mine is 18 miles from Caselton, and the Fairview is 25 miles. The crude perlite is hauled to the processing plant at Caselton via trucks. All of the deposits are large with reserves in the millions of tons. If future economics warrant it, the company may center its production at the Giant mine, thereby eliminating the truck hauls. The Giant mine alone is said to contain upwards of 14,000,000 tons of perlite ore, all of which can be mined by open-pit methods.

The Combined Metals Reduction Co. rates high in the metal mining fraternity as a developer and pioneer of metallurgical and mining practices. It was one of the first to develop selective flotation of lead-zinc sulfide ores and now has on the agenda a large scale program for processing oxide ores of lead-zinc that were formerly too complex to treat by conventional methods. This new process is a hydro-metallurgical one and lime will play an important part in the

ore treatment process. This is mentioned because it has a bearing on the perlite processing plant and because it has been designed with the thought in mind that it could be changed readily to a lime plant should it become desirable. In such an event, a new perlite operation possibly would be started at the Giant mine. However, during the pioneering of the perlite industry it was deemed advisable to have the perlite plant close to the large facilities that the parent lead-zinc operations had to offer. This includes large repair and construction facilities, well-staffed chemical and engineering offices, research laboratories, and recreational and living accommodations for men and their families. The perlite operation can draw on the technical know-how of 17 college-trained technicians who make up part of the staff of the Combined Metals Reduction Co. at Caselton.

Product Sizes

To receive the finished product there are six steel silos each holding 200 tons, arranged in a single row. Five sizes of perlite are put into these bins usually as follows:

Bin No. 1 Plus 40- Minus 12-mesh
Bin No. 2 Plus 100- Minus 16-mesh
Bin No. 3 Plus 100- Minus 12-mesh
Bin No. 4 Plus 50- Minus 30-mesh
Bin No. 5 Plus 100- Minus 50-mesh
Bin No. 6 Plus 100- Minus 50-mesh

Each bin at its outlet is provided with a short feeder belt and adjustable gate. The feeder belts in turn serve a long belt conveyor under the assembly so that one size, or a blend of all sizes, can be loaded and shipped. The main long belt under the bins feeds to a portable Barber-Greene conveyor that has an automatic sampler mounted at the upper end, so that all cars are accurately sampled

as loaded. All car shipments are given a complete screen analysis from 10 mesh through 200 mesh on eight or more sizes of screen so that shipments can be adjusted should it be desirable.

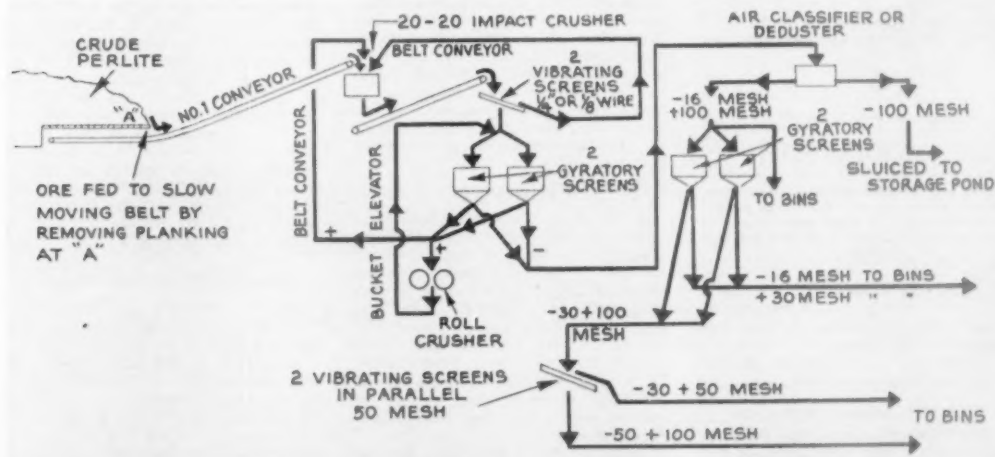
Screening

Preliminary screening in the plant is accomplished by two Tyrock screens operating in parallel. One of these screens is a small unit, but the other is an F-300. They are equipped with $\frac{1}{4}$ - to $\frac{1}{2}$ -in. wire according to shipping requirements. Crushing is done by a set of 20-20 New Holland impactors augmented by a small set of rolls. The impactor stands up reasonably well under this hard usage as it takes the mine-run and reduces it to about minus $\frac{1}{2}$ -in. in one operation. Oversize from the primary screens can be sent either to the rolls or back to the 20-20's. The operators have increased the life of the impellers measurably by use of hard surfacing alloys.

Secondary screening is accomplished by four Symons gyratory screens, and some of the final sizing is done on two W. S. Tyler Hummer screens.

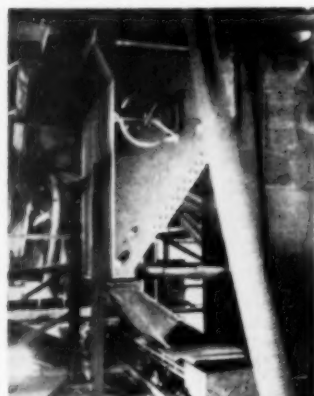
Symons gyratory screens used in this plant are among the first of these new units to go into service anywhere. The four screens are arranged in two separate batteries of two screens each. On the first set of gyratory screens it is the practice to use 12-, 14-, or 16-mesh wire according to shipping needs. If a certain size of perlite is needed the desired size of wire cloth is put on the two screens; when the bin is full, the screens are stopped and another sized wire cloth can be installed. It only takes a few minutes to make the change.

The Symons gyratory screens were described in considerable detail in the

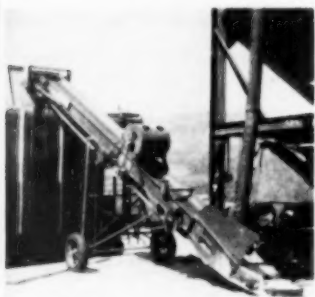


Flow diagram of the Caselton operation

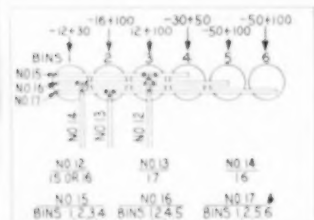
PERLITE



Dust collector in center recovers the fine sizes of perlite



Portable conveyor has an automatic sampler at the discharge and for sampling all perlite that is shipped



This shows the unique conveyor arrangement. Bottom line lists the bins the shuttle conveyors discharge to; line above that indicates to which shuttle conveyor each inclined belt delivers

September, 1950, issue of *Rock Products* in connection with a pumice operation where the screens were first encountered. However, a brief review of these new developments in the screening world is in order.

Gyratory Screen Operation

The Symons screen was invented by the same men who invented the Symons cone crusher. The screen in the West is manufactured and sold

by Symons Bros. Co., North Hollywood, Calif., and the Nordberg Mfg. Co. of Milwaukee, Wis. has manufacturing and sales rights for the balance of the United States and foreign sales. The screen is made in one size, 3 ft. high and 12 ft. in circumference, and is equipped with one size of wire only. The unit is mounted vertically and is so designed that the screen rotates at 960 r.p.m. and gyrates at the same time at the rate of 70 gyrations per minute. It is enclosed in a dust-tight steel housing. Feed is introduced inside the screen and at the top and the centrifugal action throws the material against the inside of the screen. However, due to the gyratory action, the oversize does not cling to the inside of the screen but instead at each gyration the screen pulls away from the material, allowing it to drop a fraction of an inch, after which the material again impinges against the wire. The gyratory effect overcomes the older objections to screens of the centrifugal type in that it allows the oversize particles to be released repeatedly and to drop out of the unit into the steel hopper below. At Casleton the screens operate dry and each is powered by a 5-hp. U. S. Synco-gear motor.

The screens have high capacity as the material is screened under the equivalent of 5 G's (five times gravity). They are comparatively inexpensive as to first cost, it was said, and they are easy to install and take up very little floor space. With this perlite the wire cloth tends to bulge under the centrifugal action, and as there are no provisions in the design for pre-drying, the material screened has to be reasonably dry. Life of the wire screen is said to be longer than for some other types of screen mainly because there is no drag across the face of the wire; rather the particles impinge against it, are held there a fraction of a second, then follows a free drop after which impingement takes place again. The ratio of 14 r.p.m. to one of gyration has been found to be optimum for most materials. A higher ratio causes bouncing action and a lower ratio causes the material to cling to the screen too much of the time.

Flow Plan

In the flow diagram we have used minus 16-mesh material as an illustration. If minus 12- or minus 14-mesh material is desired the wire cloth on the first battery of gyratory screens is changed accordingly. It will be noted that in all cases, whether 12-, 14-, or 16-mesh, the material is dedusted in a Western Precipitation Corp. air classifier with the minus 100-mesh material later sluiced to storage ponds. The plant has a capacity of 25 t.p.h.

Belt conveyors are used for the most part to transfer material; however, there are four bucket elevators

in the plant. These elevators are unique in that they all have a circular housing instead of the more conventional rectangular housing. The steel is 3/4-in. cold rolled and the housings are about 3 ft. in diameter. They are of welded construction and are very rugged and stable pieces of equipment. The circular design means that no additional bracing is required, so the drive assembly is mounted at the tops without additional supports.

The final sizes of perlite are delivered to the steel silos by one of three inclined belts. These belts serve three other horizontal running belts mounted on top of the bins and are so arranged that all silos can be filled with its product. Flexible metal tubing connected to fans collects dust throughout the plant.

Mining Practices

At the mine, open-pit mining is practiced with a drag scraper passing the material over a 3-in. grizzly. The coarse material is stockpiled separately for that size of material is easier to process in winter months. "Throw-away" drill bits are used here and in the lead-zinc mining operations. This drill bit resembles a conventional "cross" bit. It is designed to be used until its cutting value has ceased, after which the bit is thrown away and not resharpened. The bits were said to be very satisfactory for their work and in some quartzites get as much as 3 ft. per bit, whereas other types of bits gave only 3 in. Throw-aways had overall savings as compared to other types of bits, it was said. The bits used are Liddicoat drill bits, Type 2-L-1, and were supplied by the Western Rock Bit Co. of Salt Lake City.

Personnel

The offices of the Combined Metals Reduction Co. are in the Felt Building, Salt Lake City. E. H. Snyder is president and general manager; W. H. Kelsey is chief engineer; S. S. Arentz, Jr. is general superintendent of the company's Nevada operations; W. G. Fidler is concentrator superintendent; John Ridges is plant engineer, and R. H. Godbe is assistant superintendent in charge of perlite operations. Neal Snyder is manager of the Panacalite Division with offices in Salt Lake, and J. H. Bradford is director of research.

Injunction Against Noise

ROSLYN SAND AND GRAVEL CO., Roslyn Heights, N. Y., has had an injunction brought against it for the use of a noisy hopper. The court ruled that the sand pit may continue to operate as long as equipment is used that does not interfere with the peace and quiet of the neighborhood. The pit is in a residential area and the offending hopper thereby violates local zoning laws.



General view of Irwindale operation. Crushing plant is in background, right, with preliminary dry screening plant in foreground. Final screening section is at left.

Steps in Keeping An Aggregate Plant Up to Date

One of California's largest plants, operated by Consolidated Rock Products Co. at Irwindale, is continuously undergoing improvement and modernization to guarantee capacity operation

THE IRWINDALE, CALIF., PLANT of Consolidated Rock Products Co., Los Angeles, is the largest producer for the company and is also one of the largest sand and gravel plants in southern California. It also is well up on the list of big producers when the United States as a whole is considered.

Large plants like these which are capable of turning out 1000 t.p.h. or more, day in and day out, must be well designed and constructed, and to be profitable they must keep up a standard of modernization that is a continuous revamping and rebuilding program. The Irwindale plant is in that class and its production manager,

R. C. Griffin, in cooperation with the other executives of the company and the engineering staff, under the direction of Byron Weintz, chief engineer, is doing work there that will have a recognized and permanent place in the rock products industries.

President of Consolidated Rock Products Co. is Robert Mitchell who is well known for his active part in the affairs of the sand and gravel association. Quintin W. Best is vice-president. Mr. Best also is president of the Saticoy Rock Co., Ventura, Calif.

Safety Record

The Irwindale plant won the 1946 Rock Products Safety Trophy in the contest sponsored by the United States Bureau of Mines. Frank Carroll, superintendent, was at the National Sand and Gravel Association, held in 1948, in Cincinnati, Ohio, and he accepted the trophy on behalf of the company. The trophy is mounted in the office at the plant.

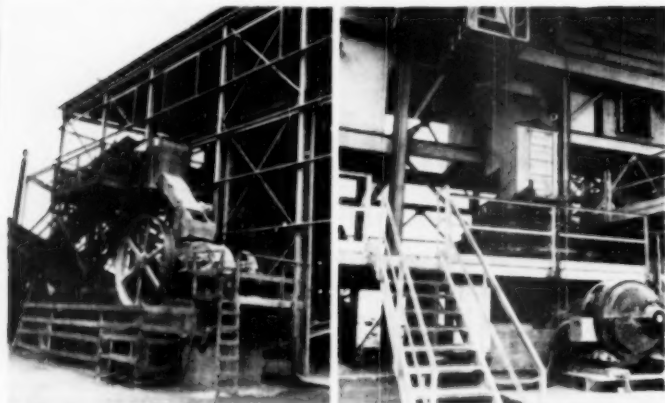
This large operation is made up of segments, any one of which carries out its part of the entire program in a somewhat different manner from general practice as found in the South, or in the area east of the Mississippi river. The operation is an old one and the experiences of yesterday and the day before and back through the years have more or less crystallized into a



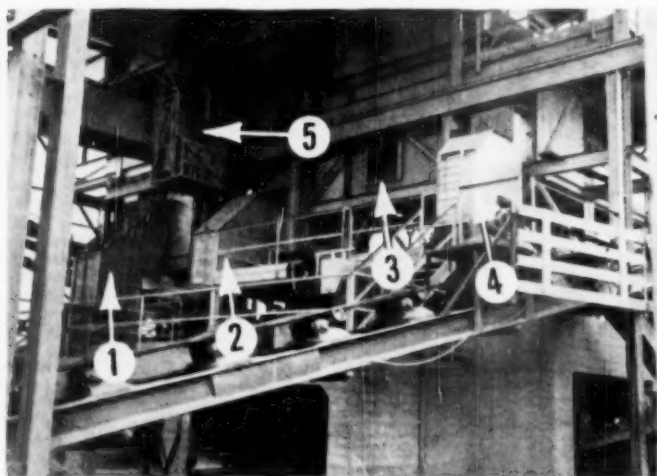
Irwindale-Baldwin Park gravel pit



Crushing plant as seen from top of final screening section



Left: Set of rolls used to recrush unwanted sizes. Right: The 5½-ft. cone crusher with fine bowl. Note neat steel feed housing to crusher



Interior view of secondary crushing plant showing (1) feed housing to 7-ft. cone crusher; (2) feed housing to 5½-ft. cone; (3) spare opening for a fourth cone crusher; (4) feed housing to 4-ft. cone, and (5) high capacity electric hoist

pattern that could be said to be southern Californian.

Segments of Operation

The segments of the operation could be divided up as follows: (1) pit operations and primary crushing, (2) field conveying and surge pile, (3) primary (bull) screening to make a true gravel product and to separate it from the to-be-crushed gravel, (4) secondary crushing plant, (5) preliminary (or secondary) screening following secondary crushing, (6) final screening, and (7) sand and gravel washing.

In the above segments, if we are to pick out one that is more novel we might turn to No. 3, for there, as is the case in practically all the larger plants in southern California, two products are made, and they are kept separate throughout the rest of the flow design. The gravel portion is washed and from it the sand is derived. The crushed portion is kept separate but is not washed.

Segment No. 5 should be closely tied in with this technique because in this separate and distinctive part of the operation, the "rock" that has been crushed is again split into two fractions, plus ¾-in. and minus ¾-in. sizes, and kept separate throughout. This makes the crushed rock portion of the plant set-up still more unusual, for there we see the products mentioned above going to the final screening plant, each product on its own inclined belt conveyor and each to its own battery of final screens, after which it is binned and stored according to the particular sizes in greatest demand each day. For instance, if plus ¾-in. minus ¾-in. is in greatest demand, then that is the size the plant concentrates on. It may be any of the other sizes such as plus 1-in. minus 1½-in., plus ¾-in. minus 1-in. or minus ¾-in.

During the past year segment No. 6 has received its share of improvements and additions, particularly for the sizing of the minus ¾-in. crushed rock. Six Hummer screens were installed to screen these fine sizes properly. This gives the plant a total of nine of these screens as three others are mounted below the former.

Some of the practices at Irwindale possibly can be traced to the type and the extent of the deposit, for it covers a large area and is exceptionally deep, with little or no water encountered above the 150-ft. levels. The gravels are a part of the San Gabriel "wash" or alluvial cone. Three other large producing plants are bunched in the same general area. One of these plants is the Largo operation of the Consolidated Rock Products Co. It is near Azusa and alongside Foothill Boulevard that connects Los Angeles and San Bernardino.

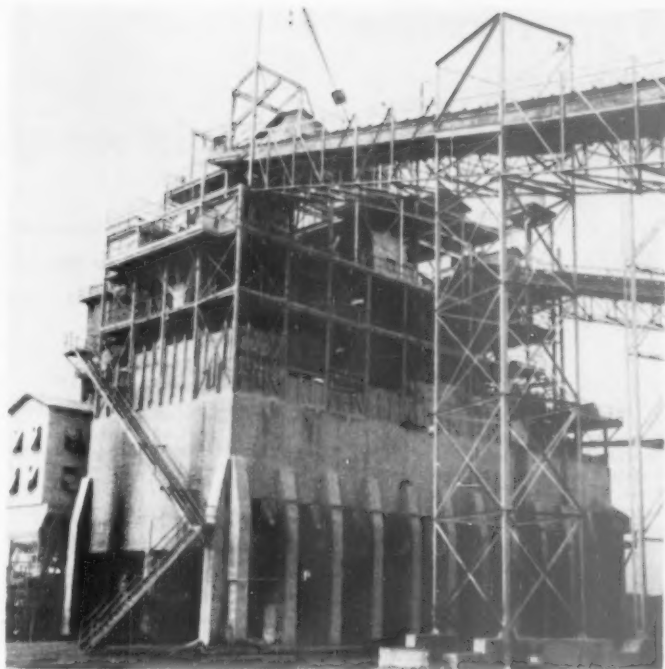
Pit Operations

The pit operations at the Irwindale plant include the recovery of rock, sand and gravel from the acreage

around the old Baldwin Park plant which is one-half mile from the Irwindale plant. At the time of inspection all the material was coming from that deposit.

The illustration shows the pit operations in a nut shell. The field conveyor operating for most of its length horizontally ends at a field hopper that receives its material from a No. 1201 Lima 2½-cu. yd. diesel-driven shovel, and an 80-B Bucyrus-Erie electric shovel also with a 2½-cu. yd. bucket. Long booms and long dipper sticks are featured here with 43-ft. lengths for the boom and 32-ft. lengths for the dipper stick. These work one on each side of the field hopper. The high bank (90 ft. in the illustration) is kept at a safe slope by means of a K-375 Link-Belt diesel dragline excavator that slings a drag or bucket specially-designed to efficiently rake down the bank. The horizontal field belt was, at the time of inspection, 700 ft. long. It is made up of 22-ft. sections, and as the length of the haul increases the belt is increased accordingly. It takes about an hour to set in a 22-ft. section and to splice in the added length of belt. Flexo belt lacings are used on this section of the belt system. The field belt feeds a 36- x 48-in. Llewellyn Blake-type jaw crusher and from time to time large boulders are encountered that are too large for this unit, so they are set aside. The larger boulders are broken by a drop ball in conjunction with the truck clam. When the end of the property line is reached by this field conveyor, side splices can be made. Eventually the area will be mined to about the 150-ft. depth which is, generally speaking, the water line. This water line, however, varies with yearly cycles. The past four or five years the water has been much lower than 150 ft.

About two years ago the company reopened the Baldwin Park pit to supply the Irwindale plant. To reach it one of the longest conveyor belts in southern California was installed. This belt conveyor serves a surge pile that is located in a worked out part of the original Irwindale pit. The surge pile is made up of the minus 6-in. materials from the primary crusher. This long belt was the first of its type to be used on the Pacific Coast and in



Closeup of final screening section. Conveyor gallery, foreground top, actually is two parallel conveyors. One carries minus ½-in. material and the other carries plus ½-in. top size

the February, 1949, issue of *Rock Products*, some of its main features were described. It is a 36-in. belt, 6-ply cord type and was supplied by the B. F. Goodrich Co. The section of belt is 4717 ft. long and came in five rolls. The splices were vulcanized on the job. The belt is driven by a 200-hp. 4000 volt G.E. motor through a Western Gear reduction unit. The carrier and return rolls were supplied by the Conveyor Co. of Los Angeles. The vulcanized joints have stood up well during more than two years of usage.

The surge pile at the end of this long belt has its material reclaimed by a reclaiming belt that serves the "bull" screen where a separation of the gravel and the rock to be crushed is made. The size of the gravel sent to the gravel plant can be gauged by

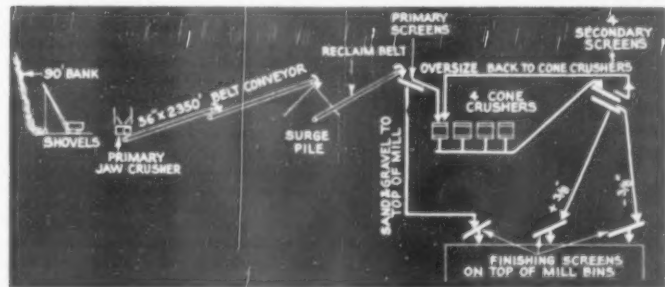
the needs of the plant but seldom is in excess of 2½ to 3 in. The oversize from this bull screen goes to bins that serve the secondary crushing plant.

Secondary Crushing

The secondary crushing plant is a neat and well-designed structure of steel throughout and in it are four Symons cone crushers. Three have been in operation for a year or more and the fourth was put into operation July 28, 1950. The four crushers are mounted in a straight line. At one end is a 7-ft. standard cone, next is a 5½-ft. standard with a fine bowl, a 5-ft. short head next, and at the other end of the line is the 4-ft. standard that also has a fine bowl. The crushers all discharge to a belt conveyor that delivers to the secondary screening plant. Over the line of cone crushers is a Bedford electric crane that has lifted crusher parts that weighed in the 35-ton range. The 7-ft. Symons cone is one of the few crushers of this type and size in any rock products plant on the Pacific Coast. It is powered by a 300-hp. type CW Westinghouse induction motor.

In segment No. 5, or the secondary screening section, is a battery of four F-600 Tyrock screens, all double-decked units and operated dry. The screens are in tandem; that is, two rows of two screens each and the materials from the top screen can, if desired, cascade to the lower screen.

(Continued on page 143)



Diagrammatic sketch of flow of materials at Irwindale plant

Aggregates

Production of Lightweight Aggregate

Armour Research Foundation has made exhaustive study of raw materials with and without naturally expanding properties to stimulate establishment of new sources of lightweight aggregates

By **THOMAS C. MILLER***

constructed from lightweight aggregate concrete during and immediately after World War II.

Historical Development

Lightweight aggregate is not a new material. Pumice was used as an aggregate about 2000 years ago for tem-

ples and public baths in Rome. However, its use was not very widespread and few records of its application were made until the middle of the 19th century in Germany. The use of pumice-concrete then spread rapidly to other European countries. The use of pumice as an aggregate was not exploited to any great extent in the United States until 1935, in spite of the abundant supply in the Southwest. Cinders have been used in concrete for approximately 50 years and have proved their usefulness. The first expanded shale was made in 1913 but Haydite was not patented until 1918. The first commercial plant was constructed in 1920. Blast furnace slag aggregate was patented in 1928 as a result of investigations made on slag from a Chicago steel mill. The increased demand for aggregate has prompted the use of more widespread raw materials or by-products to overcome high transportation charges. Shale and clays have received the most attention but an increasing interest in such by-product materials as phosphate slimes¹ and coal mine waste² is apparent.

Aggregate Classification

Lightweight concrete aggregate may be divided into two groups depending upon the bulk density. Those aggregates having a bulk density of 3 to 25 lb. per cubic foot usually produce concretes exhibiting low strengths (100 to 1000 p.s.i. at 28 days). Perlite and vermiculite are of this group. A second group comprising the larger number of aggregates employed in the construction field includes pumice, cinders, expanded blast furnace slag and expanded shale and clay. The second group can be further divided into the natural aggregate such as pumice, and manufactured types such as sintered aggregate and expanded slag aggregates made from blast furnace slag. Sintered aggregate may be produced in a rotary kiln or in a sintering machine. Shale and clay may be sintered in a rotary kiln, with subsequent crushing or sizing, or individual particles of aggregate may be produced from presized crushed shale or clay or from pelletized shale or clay. The average weights of dry

AT NO TIME in the history of the construction industry has there been so much interest in lightweight materials of all types. The extremely low-density aggregates, perlite and vermiculite, have been much in demand, as well as the somewhat heavier aggregates such as cinders and those prepared from slag, shale and clay. The primary interest of Armour Research Foundation is in the second group of aggregates which are used in cast-in-place concrete construction or masonry unit manufacture.

The demand for aggregate of all types for the production of concrete block has reached an average of 18,000,000 cubic yards per year for the past three years, from which 1 billion block per year (55 block per cubic yard of aggregate) are manufactured. An estimated 35 to 40 percent of the demand for lightweight aggregate can be supplied while 60 to 65 percent is yet to be produced.

Research on Aggregates

The need for information on the manufacture and properties of lightweight aggregate has prompted the initiation of work by several bureaus of the Federal Government. Notable work has been done by the United States Bureau of Mines at Tuscaloosa, Alabama; Norris, Tennessee; and College Park, Maryland. Results of these researches are given in the Bureau's Report of Investigations, R. I. 4401, by Conley, Wilson, Klinefelter and others.

The advantages in the use of lightweight concrete aggregates are to be found in improved properties of concretes made therefrom, including better fire resistance, heat and sound insulation, lowered unit weight, with adequate strength. In multistory buildings an appreciable saving in steel is obtained with the added benefit of better thermal insulation in both walls and floors and lowered dead loads. The San Francisco-Oakland Bay Bridge was built with concrete made from lightweight aggregate and a saving of \$3,000,000 in structural steel was realized by it. Barges were



The author has had varied experience before embarking upon this study of lightweight aggregates. Following his education at University of Tennessee, Knoxville, and University of the South, Sewanee, he was employed by Gager Lime Manufacturing Co. from 1926-1942, serving as chief chemist from 1931. There he specialized in lime plant construction, control and operation and studied special properties of lime products for the chemical industry. In 1942 he joined Universal Atlas Cement Research Laboratories at Buffalo, working in chemical analysis of cement products and supervision of the experimental research plant. In 1945 he was appointed to the research staff of The Armour Research Foundation, where he became supervisor of the Masonry Materials Section.

—THE EDITORS

*Supervisor, Masonry Materials Section, Ceramics and Minerals Dept., Armour Research Foundation, Chicago, Ill.

aggregate and of concrete containing the aggregate are shown in Table I.

Table I: Average weight of aggregate^a and concrete by type of aggregate

Aggregate	Dry Weight lb./cu. ft.	Concrete Weight lb./cu. ft.
Gravel	129	150
Sand	90-129	150
Crushed Stone	100	145
Crushed Slag	80	110-130
Haydite	40-60	100-130
Foamed Slag	40-60	90-100
Cinders	40-50 (cinders)	110-115
Pumice	30-60	60-90
Perlite	6-16	40-65
Vermiculite	6-10	25-50

Expansion Factors

The general reactions for the formation of the more widely known aggregates are as follows.

Perlite. Perlite is the most recently developed lightweight aggregate. The raw material is an acidic volcanic glass found wholly within the western areas of the United States. It is transported to various sections of the country for processing and has been shipped as far east as Pittsburgh.

Perlite contains 2 to 5 percent water and is capable of expanding 6 to 10 times its original volume when subjected suddenly to temperatures from 1800 to 2000 deg. F. The product may be made to weigh as little as 3 lb./cu. ft. when properly sized raw material is used. The degree of expansion of perlite may be controlled by regulating the amount of water present at the time of heating, the size of material as charged to the furnace, and the temperature of heating. Numerous patents have been taken out for specially designed furnaces for the manufacture of a given type of product. Perlite aggregate will make 35 to 60 lb./cu. ft. concrete.

Perlite is often used as a loose-fill material. However, increasing interest is being shown in its properties as insulating aggregate in plaster.

Vermiculite. Vermiculite is a hydrated magnesium aluminum silicate micaceous mineral found in Montana, Wyoming, Colorado, South Carolina and North Carolina. When heated to 1800 deg. F. for 4-8 seconds, the mineral exfoliates by the expulsion of water and forms accordion-shaped particles 6 to 20 times the volume of the raw material. Vermiculite aggregate may be made to expand to 6 lb./cu. ft.

Expanded vermiculite has long been used as a loose-fill material but it is increasingly in demand for plaster aggregate and for use in low strength concrete, especially as roofing slabs.

Blast Furnace Slag. Blast furnace slag is expanded into an aggregate by treatment with steam. In one process, the molten slag from the blast furnace, at 2600 deg. F., is poured into a pit in the shape of a truncated cone, 15 ft. deep and approximately 20 ft. in diameter at the top and 15 ft. in diameter at the bottom. The bottom of the pit is provided with numerous trenches for the storage of water. Water in the ratio of 1 part to 3 parts of slag is added to the pit prior to the addition of slag. This

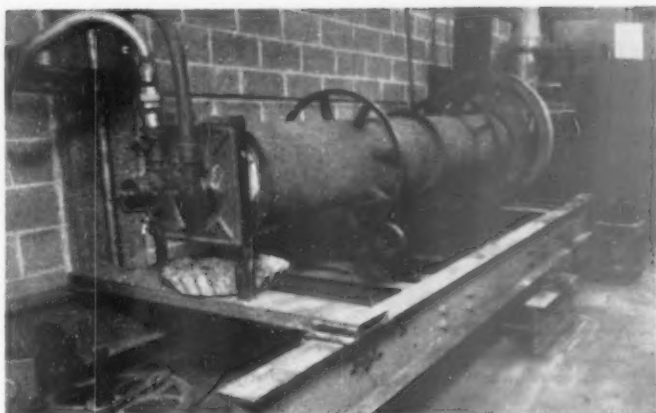


Fig. 1: Laboratory rotary kiln, 6 in. x 5 ft.

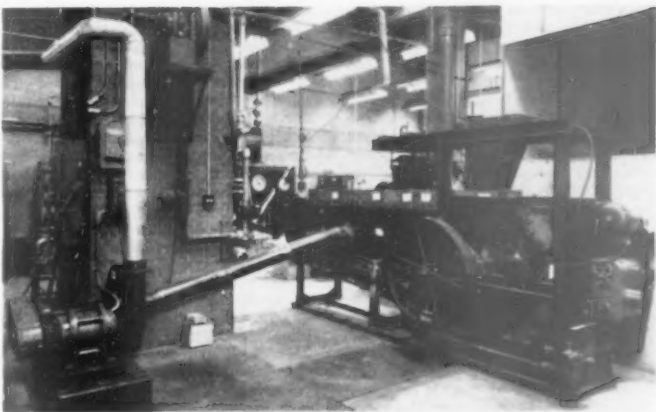


Fig. 2: Experimental Dwight-Lloyd sintering machine with 4-ft. windbox

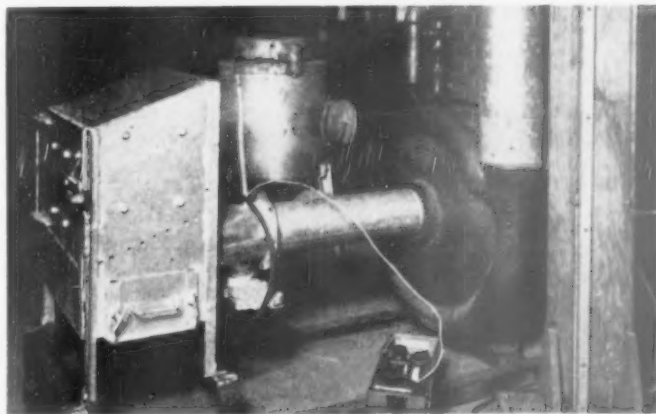


Fig. 3: Experimental 10- x 16-in. Mace sintering hearth

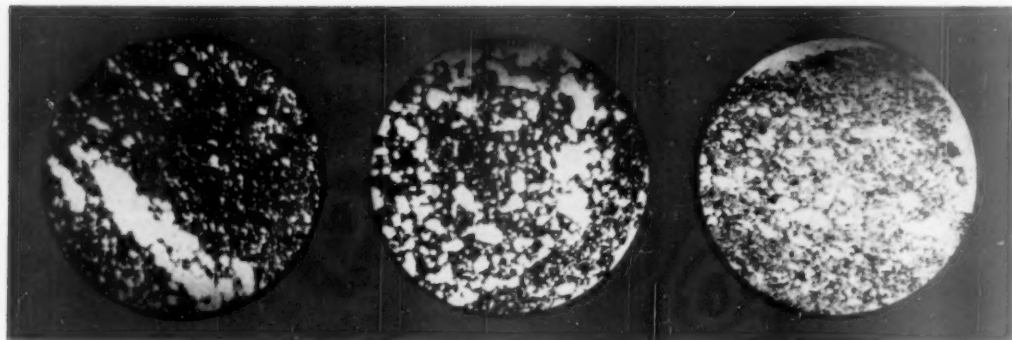


Fig. 4: Photomicrograph of rotary kiln aggregate from crushed shale. 50 X

Fig. 5: Rotary kiln aggregate from pelletized clay with 1.5 percent sawdust. 50 X

Fig. 6: Rotary kiln aggregate made from laminated Indiana shale. 50 X

provides sufficient water for steam to vesiculate the slag to a density of 45-55 lb./cu. ft. If too little water is used, proper steaming cannot be accomplished, or if too much water is used the expansion will be increased undesirably and will result in poor-strength "pop-corn" slag. The expanded slag is crushed and sized after cooling.

Expanded slag is the most economical of all lightweight aggregates. The average cost during 1948 was \$1.88 per cu. yd. f.o.b. the plant. In steel-producing areas blast furnace slag aggregate will be a strong competitor of the more expensive types of aggregate. However, the quality of slag aggregate cannot be controlled as closely as that of other materials. The quality of iron ore may vary considerably, causing a variation in the flux material which in turn affects the slag. The steel mill is primarily interested in making steel and the slag is an unavoidable by-product. Consequently, the expanded slag aggregate producer must utilize what is available. Slag aggregate is rarely transported over great distances because the local demand is more than the production, but transportation costs can become a problem if production is great enough to require a greatly enlarged market.

Clay, Shale and Slate. The reactions for the conversion of clay, shale or slate into expanded aggregate are not as simple as those involved in the expansion of perlite, vermiculite or slag. Clays and shales are generally composed largely of hydrous aluminum silicates associated with a variety of impurities. Because of the complexity of the materials, predictions of the suitability of a clay or shale for manufacture into expanded aggregate cannot ordinarily be made. The evaluation of a material for the production of expanded aggregate then involves preliminary study and experimentation.

The alumina-silica-water constituents of clay and shale may be present in various molar proportions. Associated with these compounds are sometimes found other minerals such as quartz or hydrous silica; feldspar; mica; alkalis; iron, as silicate, oxide, carbonate, hydroxide or sulfide; calcium and magnesium carbonates; and sulfates and organic materials in various forms. Considerable water may be present as free moisture and chemically combined water. Several of these minor constituents may cause expansion or assist in the bloating phenomenon. Some difference of opinion has been expressed about the role of

either the free water or combined water, but it appears quite obvious that where heating takes place gradually, as in a rotary kiln, most of the water is expelled before expanding temperatures are reached. Little benefit is sometimes obtained from the carbonates because they too are expelled at a lower temperature than that at which expansion takes place. Of the remaining "impurities" the greatest expansion is brought about by the sulfates, which decompose at the higher temperatures to evolve SO_2 or SO_3 . The combustion of organic materials also further increases expansion.

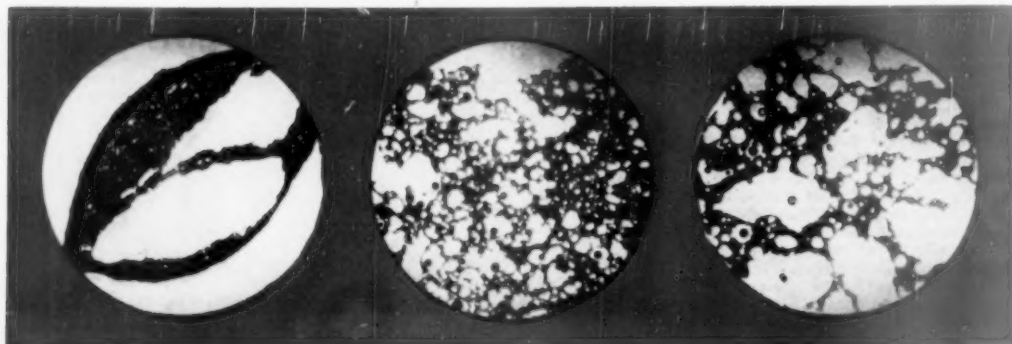
All clays or shales do not contain bloating constituents and therefore do not produce expanded aggregates. Those which are naturally expanding materials possess certain basic characteristics which set them apart from other clays and shales. At an acceptable heating temperature the material must:

1. Form a melt capable of entrapping escaping gases
2. Contain sufficient gas-forming materials to expand the melt
3. Release gases for expansion over a wide temperature range
4. Partially melt to a liquid of such a viscosity that high strength

Fig. 7: Overexpanded rotary kiln aggregate from fine minus $\frac{1}{4}$ -in. Illinois shale. 50 X

Fig. 8: Sintered aggregate from Illinois shale, same shale as shown in Fig. 4. 50 X

Fig. 9: Overexpanded sinter aggregate; compare this with Figs. 4 and 8. 50 X



will be retained after maximum expansion of the gases

- Expand at a temperature sufficiently low to assure an economic commercial operation.

The expansion of clay or shale by rapid sintering or by gradual heating in a rotary kiln is more easily envisioned than accomplished. However, the chemical and physical reactions of constituents enable an orderly temperature schedule to be set up in order to obtain the desired reactions in the proper sequence. These include:

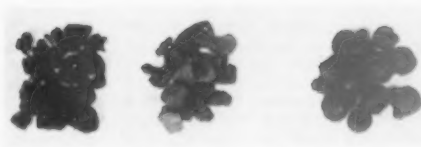
1. Loss of mechanical moisture
2. Loss of hygroscopic moisture
3. Loss of chemical moisture
4. Oxidation reactions
5. Dissociation
6. Vitrification
7. Bloating

The bloating temperature range is of great importance in the production of aggregate. The temperature should not be extremely high (less than 2300 deg. F.) and the range through which the bloating takes place should be as great as possible (not less than 50-75 deg. F.).

Shales and clays of a non-expandable nature are by no means to be disregarded as useless materials. The sintering process, employing fuel mixed with the raw material, in many cases will produce a satisfactory expanded mass from certain gas-forming constituents of the fuel. When no expansion takes place under these conditions, certain ingredients may be mixed with the finely ground raw material to promote, assist, or cause expansion. Among the most promising expanding agents are powdered coal, fuel oils, pulp-mill waste, gypsum, salt cake and other materials. Good results have been obtained with sawdust. For rotary kiln operation the expanding agent is incorporated in the pelletized, finely-ground raw material.

Armour Research Foundation has been engaged for the past two years in a study of numerous raw materials for lightweight aggregate production from various localities between New England and Iowa. Approximately one-half of the 60 materials studied were naturally suitable and the remainder were capable of being converted into suitable materials either in the rotary kiln or the movable grate or stationary grate sintering machines, when an expanding agent was incorporated with the material. The rotary kiln and two types of sintering machines are shown in Figs. 1, 2 and 3. The rotary kiln, 6 in. in internal diameter and 8 ft. long, is lined with magnesite arch brick to withstand temperatures to 2800 deg. F. and is fired with either oil or gas fuel. The movable grate sintering apparatus is a Dwight-Lloyd laboratory machine with a 4-ft. long windbox. It operates at 20 in. of vacuum and produces a clinker 12 in. wide, 6 in. deep and 9 in. long in cast iron pallets. The speed of travel of the pallets can be varied from 1 to 7 in. per min. The

Fig. 10: Comparison of sinter aggregate with rotary kiln aggregate with and without expanding agent; crushed sinter (left), sized shale from rotary kiln (center), and pelletized clay from rotary kiln (right)



stationary grate sintering machine is a laboratory Mace sintering hearth (The Mace Co., Denver, Colo.) having a hearth area of 10 x 16 in. and operating at 20 in. of vacuum. Results from the 6-in. x 8-ft. rotary kiln have been confirmed with a 3- x 30-ft. laboratory kiln.

The mere expansion of a shale or clay will not justify the claim that the product is a good concrete aggregate. Research and testing are required to determine the allowable expansion, which will give a product of acceptable crushing strength. Excessive expansion produces low unit weight but also gives poor crushing strength and weak concrete. The water absorptivity of the aggregate is also of much importance.

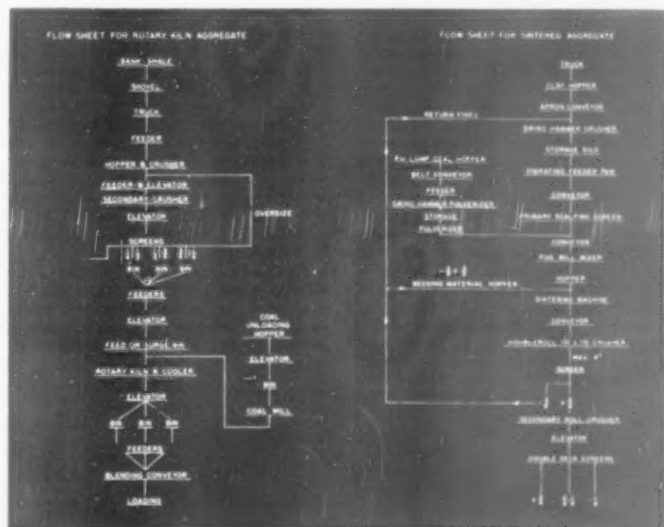
One of the primary objectives in the studies at Armour Research Foundation was to develop an economical method of producing aggregates of low absorptivity and high quality. Efforts were made to produce discrete particles of aggregate with an impervious coating as distinguished from a crushed sintered product. The work eventually included studies of both rotary kiln and sintering machine operations.

Photomicrographs of thin sections of several samples of aggregates are shown in Figs. 4, 5, 6, 7, 8 and 9. All photographs were taken at a magnification of 24 diameters. The aggregate

shown in Fig. 4 was made from Illinois shale ($\frac{1}{4}$ to $\frac{1}{2}$ in.) heated in the rotary kiln. Fig. 5 shows the product from a pelletized Chicago clay containing 1.5 percent sawdust. The small discontinuous voids of these aggregates may be compared with those in a product made from laminated Indiana shale (Fig. 6), which show horizontal voids at the plane of each layer of shale. Some of the voids appear to be continuous, indicative of a poor aggregate. An illustration of a small particle of overexpanded shale is shown in Fig. 7. The impervious outer shell of each of these aggregates, as shown by the dark, almost solid section in each field, should be noted for comparison with the illustrations of crushed sintered aggregates shown in Figs. 8 and 9. The product obtained from a normally expanding shale of good strength, exhibiting an abundance of uniform, non-continuous voids, as shown in Fig. 8, is a far better aggregate than the overexpanded, large-void material of Fig. 9. This latter material possesses a weak cellular structure, has a high water adsorption, and undoubtedly would produce a concrete of inferior quality.

Photographs of crushed sinter and rotary kiln aggregates, with and without an expanding agent, are shown in Fig. 10. The rotary kiln product containing no expanding agent was made from crushed shale while the other

Fig. 11 (left): Flow sheet for typical rotary kiln plant. Fig. 12 (right): Flow sheet for typical sintering plant



product was made from loess pelletized with 1.5 percent sawdust. A sample of this latter product was of such a low bulk density and impermeability that it floated on the surface of water. After exposure to this action for approximately 8 months it has shown only slight admission of moisture through the outer coating.

Recent interest in the utilization of trade wastes and by-product materials for aggregate production is additional proof that research will be responsible for more and more materials being used in this manner.

Crushed sintered aggregate has been recommended as a suitable ingredient for the production of masonry building units, while the smooth, more rounded particles are best for cast-in-place concrete.

Aggregate Production

Commercial production of lightweight aggregate from clay, shale or other similar material is accomplished with either a rotary kiln or with a sintering machine. The rotary kiln can be used to produce a sintered mass, which is subsequently crushed and sized to meet consumer demands, or discrete particles of a given size range can be made from presized material. The sintering machine may be of two general types, i.e., the traveling grate mechanism or the fixed hearth grate. The choice of the process will depend upon the type of raw material available and the kind of material demanded by the market. The processes and equipment are discussed below.

Rotary Kiln—With Expandable Raw Materials

Sizing After Sintering. The method of sintering clays and shales in the rotary kiln was developed as the Haydite process, in which the raw material is crushed to pass a 1½-in. screen. Material is fed to a coal-, oil- or gas-fired rotary kiln which is usually 50 ft. to 90 ft. in length. The operating temperature is dependent upon the vitrification of the particular material being used but it is usually somewhere near 2000 deg. F. Raw material flows countercurrent to the fuel and the period of time in the heating zone will vary from 30 to 40 min. The sticky mass is discharged from the kiln as large lumps which are allowed to cool. After cooling to room temperature the fused mass is crushed and sized. The process may be used efficiently in conjunction with brick production.

The cost of a plant producing 75 cu. yd./24 hr. day of 45 lb./cu. ft. ag-

gregate in a 5- x 60-ft. kiln with the necessary auxiliary equipment such as crusher, hopper, roll crusher, feeder, elevators, screen conveyors and bins, erection and transportation allowed, has been estimated at approximately \$60,000. A plant for expanding 300 cu. yd./24 hr. has been estimated to cost approximately \$150,000. Extensive quarry equipment may increase the latter cost by an estimated \$65,000.

Presizing Raw Material Before Heating. An improved process, from the standpoint of material handling and quality of product, is the production of individual particles of aggregate with an impervious coating. Fewer plants will be built using presized crushed shale or clay because of the scarcity of suitable material. However, research will seek these materials out. In many cases it will be necessary to use shales, clays, slates, waste by-products and other suitable raw materials in a pelletized form, either without an additive to aid expansion or with some expanding agent to utilize an otherwise useless material.

A bloating shale, clay or slate is first crushed to the desired size range. In order that crushing of the product may be eliminated as completely as possible, the size range should include particles from the smallest size practical for kiln treatment and up to ¾ in., for the finished product.

A process for the pelletization of a dry shale, clay or by-product material will employ a pulverizer for producing a fine powder, followed by a pelletizer consisting of a rotary drum with fixed flights about its periphery over the entire length. Water added with the powdered material at the charging end of the pelletizer will produce spheres of a given size range depending upon the speed of the machine and the quantity of water. Good pellets of uniform size can be produced with 7 to 10 percent of water.

Materials lacking plastic qualities will require use of a highly plastic clay to cause bonding. Clay possessing intrinsic expanding characteristics will be found beneficial. Research will be necessary to determine the type and quantity of bonding material necessary for each kind of raw material. The size of crushed shale or clay or of pelletized material necessary to produce an aggregate of a given size range must be determined by experiment.

Equipment necessary for the pelletization process need only consist of a crusher, pelletizer and screen with such auxiliary equipment as elevators, conveyors and storage bins. Delivery

of crushed or pelletized raw material directly to the kiln is highly desirable.

A flow sheet typical of a crushed shale installation is shown in Fig. 11.

Sintering Machines

Sintering machines are increasing in acceptance as another means for producing lightweight aggregate. The process can be one of sintering alone or a combination of sintering and expansion. The former process consists essentially of heating a mixture of clay or other material, containing fuel (usually coke) in the amount of approximately 10 percent and up to 24 percent or more of water. The product is primarily a clinker in which the particles are sintered together at their points of contact, with no appreciable expansion in the particles themselves. The latter process embodies the same principles of preparing the raw material with fuel and some expanding agent where the raw material demands it. Heating of the bed of material is accomplished in a similar manner with both materials, but in this instance, expansion of the bed takes place. After cooling, the cake is crushed and the material sized to the customary range. Expanded aggregate from this process should not be greatly different from the product made in the rotary kiln.

Continuous and batch sintering machines are available for manufacturing aggregate. Each type will be discussed briefly below.

Continuous Sintering Machines. The continuous moving grate machine was originally developed for sintering iron ore but it has been adopted for use as a means of producing lightweight aggregate. Several types of machines are manufactured, among which the Dwight-Lloyd and the Leftwich are the best known. The former device has served as the starting point for the development of other machines. The Leftwich mechanism is the most recent one using the traveling grate principle for producing aggregate.

Sintering is accomplished by heating a bed of properly prepared material in the moving pallets of the machine as it travels over the vacuum portion, or windbox, of the machine. Ignition is started at the surface of the charge and is continuous over the windbox. Expansion and sintering are complete when the pallet reaches the end of the machine.

The raw material, usually containing some moisture, is prepared for sintering by disintegrating with a suitable floating-plate hammermill, or mudhog, and mixed thoroughly with approximately 10 percent by weight of properly sized coke. Expanding agents are added at this time when necessary. The mixture is then nodulized with a mixer or pug mill and placed on the pallet of the machine which has previously been covered with about 1 in. of sintered aggregate of sufficient size to be retained by the

(Continued on page 108)

Table II: Make sintering hearth

Capacity tons/24 hr.	Hearth No.	Area ft.	Cells	Price f.o.b. Factory
5-8	1	2½ x 5	1	\$1,650
15-20	1-A	4 x 5	1	4,000
35-50	2	4 x 10	2	7,750
75-90	3	4 x 20	4	12,000
125-150	4	4 x 30	6	16,000
170-225	5	4 x 45	9	22,000
230-300	6	4 x 60	12	28,000

PROPORTIONING BALL LOADING IN TUBE MILLS TO REDUCE POWER COSTS

BY INCLUDING A "CONCENTRA" built into the second and third compartments in a tube mill, it is possible to save about 20 percent of the power required to drive that mill.

As installed by Krupp, the raw mill is divided into five horizontal cells and the grinding media for two adjacent compartments have approximately the same weight, i.e., the power to lift the grinding bodies is pretty well equalized. At the same time the grinding surface is more than doubled. In that way a considerable saving in power is obtained for a constant weight, especially in the third compartment. In this way the power requirement is reduced, the feed can be increased and there is a possibility of finer grinding as compared with conventional tube mills.

Both cement grinding mills of the Grosshartmannsdorf lime and cement plant were changed over during the thirties by building a "Concentra" system into their third compartments. These mills had three compartments according to the Luther system, and total dimensions of 2 x 14 meters. The Krupp firm guaranteed a power saving of 20 percent for grinding clinker into cement, which was fulfilled.

Afterwards the second compartment was equipped with a similar installation. The average results for the years 1929 and 1940 for these two mills, in grinding well-burned cement clinker to

By DR. ING. EGON PRALLE*

about 20 mm. and with about 20 percent of blast furnace slag, showed a power requirement of 22 kw. per ton of cement, having a residue of 7 percent on the 175-mesh sieve, and with an hourly output of 17 tons.

The Krupp firm delayed pushing this installation and only one other installation was made, in the Stadt Oppeln cement plant, where experiments were conducted with the Concentra installation.

Results of Installation

Both of our 2 x 12-meter Luther raw mills were equipped with Concentra installations in their second and third compartments. The results for the years 1939 and 1940 were as follows: power requirements were 10 kw. per ton of raw mix ground to 0 to 15 mm. by a Titan mill fed a relatively hard but brittle shell limestone. The grind was to a fineness of about 6 percent residue on the 175-mesh sieve. The production was about 30 t.p.h., which amounts to about 100 kg. per kw.-hr. These figures include all the power requirements for the mill installation, including elevator equipment but not including dry dust removal or transport to the mill.

The clinker grinding mill motors had a 450 kw. rating and were loaded to 380 kw. The raw mill motors had

a 400 kw. rating and were loaded to 350 kw. After the installation, in spite of a greatly increased charge, the motors were loaded decidedly below capacity. During the year 1940, 256,000 tons of raw mix were ground and dried with a power requirement of 2,443,820 kw. Of this, the Titan preliminary mill required 1.3 kw. per ton of raw mix or a total of 330,000 kw. The dryer, the conveying equipment and the dust removal required 113,000 kw. The total power requirement on the raw side was 11 kw. per ton, giving 92 kw.-hr., which was quite favorable.

Toward the end of the war, it was planned to grind the raw stone somewhat finer in the Titan mill, to pass a 10 mm. sieve when ground with circulating load. It was also planned to install a Concentra in the first compartment of the raw mill, but this was not carried out.

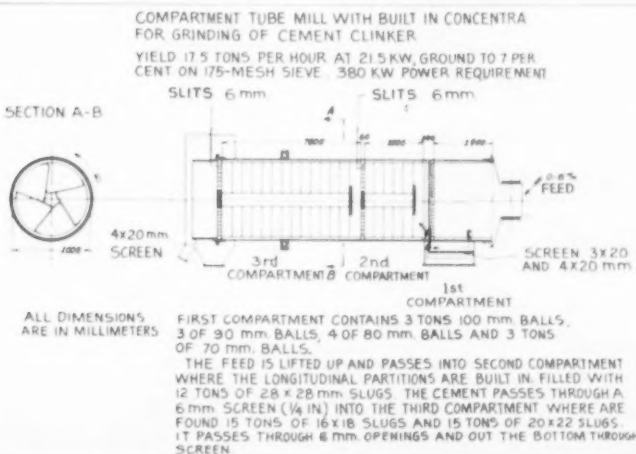
Mill Loading

Instead, a three-compartment Löhner mill, 1.8 x 10 m., was equipped with the Concentra installation; this yielded excellent results. The middle wall was later removed from this mill in order to increase the size of the first compartment in grinding limestone. Since this installation was entirely experimental, some difficulties were encountered at first. Originally, a third compartment of the clinker grinding mill had a charge of about 18 tons of flints. After the rebuilding, the flints were replaced with 30 tons of rod pieces. The weight of the installation in the two compartments was about 14 tons, whereby the total load was increased by about 30 tons. The shells of both the raw mills and the first clinker grinding mills were 24 mm. thick and were able to withstand the increased load; however, a wall thickness of 28 mm. was specified for the new clinker grinding mill. The rings were originally 250 mm. wide and had to be replaced with new rings 350 mm. wide. One of these, however, became cracked and had to be replaced with several segments in place of a single continuous ring. This gave satisfactory service. The thrust bearing, having been made of ample size and properly lubricated, gave no trouble.

The installation was as shown in the illustration. After one year a certain amount of wear developed, so that wear plates, 40 cm. wide, were in-

(Continued on page 115)

*Über Kreussen, Germany.



Thermodynamics of Lime Manufacture

Part III. Discussion of flame lengths, combustion rate, use and effect of enriched air, heat transfer rates, and kiln heat loss

By RALPH GIBBS*

FOR ALL PRACTICAL PURPOSES the fuel burning process is a volume phenomenon. The flame, however, usually is so controlled as to confine it as much as possible to the firing end of the rotary kiln.

There are several very good reasons for this. In the first place, the release of fuel heat within the limits of the smaller area of the cylinder surface will result in higher temperatures in this zone. Under these conditions, the rate of heat transfer per unit of cylinder area within this zone is increased over that of an extended area. This is illustrated in Fig. 1.

Flame Lengths

In A, the flame is relatively short. This short flame can be formed by regulating the quantity of primary air so that it is from 40 to 60 percent of the total air required for combustion. Thus the heat release occurs within the volume occupied by the flame, and this volume has a corresponding cylindrical surface within the kiln to which much of the developed heat is transferred.

By reducing the quantity of primary air for combustion and using more secondary air, the flame can be lengthened while the quantity of fuel burned per unit of time remains the same. This will give a flame of increased length as shown in B.

Since the fuel burning rate is the same in both cases, the rate of heat release also must be the same. But this heat is being released within a greater volume with a correspondingly larger heat transferring surface. This can mean only one thing. The temperatures of the heat transferring surfaces in case B will be lower than the temperatures of the corresponding surfaces in case A.

Economic Factors

It is true that some kiln operators prefer the long, lazy, relatively cool flame to the short, hot, snappy flame. They form this flame shape either by the addition of steam to the fuel stream, or by introducing some of the exit kiln gases with the air for combustion, or by using a lower proportion of primary combustion air. There is one advantage offered by this practice; the operating crews are less likely to produce over burned or dead burned lime. The other features of

the long-flame practice will prove to be economic disadvantages.

But to get on with the economic advantages of the short flame. In the second place the short, hot flame assures a maximum of the high temperature heat where it is needed most. In our previous studies it was learned that, with dry kiln feed, considerably less high temperature heat is available than required to balance the low temperature heat demand. This results in a surplus of low temperature heat which is wasted in the exit kiln gases.

In the third place, the short flame allows more of the kiln length for preheating. In subsequent studies an attempt will be made to show that adequate heat transfer surface must be provided for preheating.

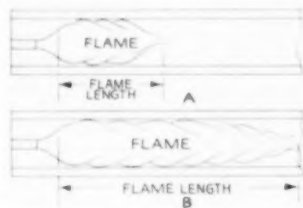


Fig. 1: Flame lengths

In the fourth place, it is not necessary to dilute the kiln gases with steam or combustion gases which carry to waste some of the heat we are trying to conserve.

Combustion Rate

Accepting the overall advantages of the short, hot flame, it is the general practice to confine the combustion process itself well toward the firing end of the rotary kiln. This results in a peculiar feature in that, regardless of the diameter of the kiln, the length of the flame will be formed within 30-60 ft. from the firing end. This means, then, that the volume of the flame is controlled more by the diameter than by the length of the kiln. We are forced to the conclusion, then, that the heat-release rate, or the combustion rate, is governed largely by the cross sectional area of the kiln.

In practice, the pressure drop through the rotary kiln has some influence also on the capacity of the system to utilize the fuel properly. Ordinarily it is found that natural draft is adequate; in many cases, however, mechanical exhausters are used to control more closely the pressure drop through the kiln. As was mentioned in a previous article, there may be some hidden advantages not yet studied or proved in the use of positive pressure above atmospheric to force the gases through the rotary kiln.

Use of Enriched Air

It may be well, while studying combustion, to examine more or less casually the use of enriched air. By enriched air we mean air, normal air, to which oxygen has been added. It is altogether possible to reduce the quantity of heat going to waste in the kiln gases by the use of enriched air.

The normal air of our atmosphere contains by weight about 23 percent of oxygen and substantially 77 percent of inert gases such as nitrogen, neon, argon, etc. Each pound of a good grade of bituminous coal requires about 10 lb. of normal air, holding 2.3 lb. of oxygen, for proper combustion. Table I shows what can be expected when the air is enriched with various quantities of oxygen.

Fig. 2 shows these relations graphically.

In an earlier article it was shown that the high temperature heat requirement for producing lime is about 2,950,000 B.T.U. ton. For the dry feed kiln the low temperature heat requirement is 1,320,000 B.T.U. ton of lime. Table II shows how the increase in available high temperature heat results in a lower exit kiln gas temperature.

Fig. 3 shows these relations graphically.

Effect of Enriched Air

These data indicate that enrichment of the combustion air to between 35 percent and 40 percent of oxygen by weight will allow the dry feed rotary kiln plant to operate with a very low heat loss in the exit gases. The recovery of heat from the discharged lime will make it possible to reduce the degree of oxygen enrichment below the value indicated above. This feature may warrant a study in greater detail and some practical experimental

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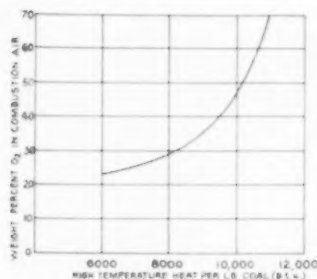


Fig. 2: Effect of enriched air in developing high temperature heat

tion. No special advantages are indicated for slurry-fed kilns.

In the normally operated kiln, the air for combustion is not enriched, however, but is provided by natural draft or exhausters. Under these normal conditions it is usually possible to burn between 60 and 70 lb. of coal per hour per square foot of kiln shell cross sectional area. This is equivalent to 800,000 to 950,000 B.t.u./hr./sq. ft. kiln shell cross sectional area.

Heat Transfer

The transfer of heat is a surface phenomenon. Heat is delivered from a surface and is received by a surface. The surface may be a very small unit, such as that of a gaseous atom or molecule, or a very large surface comparatively, such as that of an aggregate of atoms and molecules.

Heat may be transferred by any one, or by any combination, of the three different means: convection, conduction, or radiation. In the rotary kiln much of the heat of the flame in the combustion or hot zone is transferred to the kiln walls and the charge or load by radiation. As the hot flame gases travel through the kiln, they continue to radiate heat, but at a greatly decreased rate as they get cooler. Nevertheless, the gases are flowing, and it is this hot gas moving over the surfaces in the kiln that transfers a greater and greater proportion of its heat by convection. Thus the charge of material in the kiln, and the kiln lining also, receives its heat largely by radiation and convection.

Kiln Heat Loss

The heated kiln lining disposes of the heat it receives from the hot gases by radiating a portion to the charge, by a portion passing through the refractory by conduction, and by a portion passing to the particles of the charge by conduction when the surface gets under the charge. The heat escaping by conduction through the kiln lining also passes through the kiln shell by the same means. At the outside surface of the kiln shell the escaping heat is dissipated by radiation and by convection to the atmosphere. The heat thus leaving the sys-

Table I: Effect of enriched air in developing high temperature heat

Percent of oxygen by weight in combustion air	Lb. air per lb. coal	Lb. of combustion gas lb. coal	Theoretical flame temp. deg. F.	H-T-H per lb. coal B.t.u.
23	18.00	10.96	4450	5,850
30	7.70	8.66	5750	8,120
40	5.75	6.71	7450	9,500
50	4.60	5.56	9000	10,700
60	3.84	4.49	10400	10,600
70	3.29	4.25	11750	10,500

Table II: Effect of increasing high temperature heat on kiln gas temperature

Percent of oxygen by weight in comb. air	Lb. of coal to supply H-T-H	Total B.t.u. fired per ton of lime	Low temp. heat in exit gases	Exit gas temp. deg. F.
23	497	6,700,000	3,750,000	1440
30	364	4,900,000	1,950,000	1750
40	311	4,200,000	1,250,000	insuff.

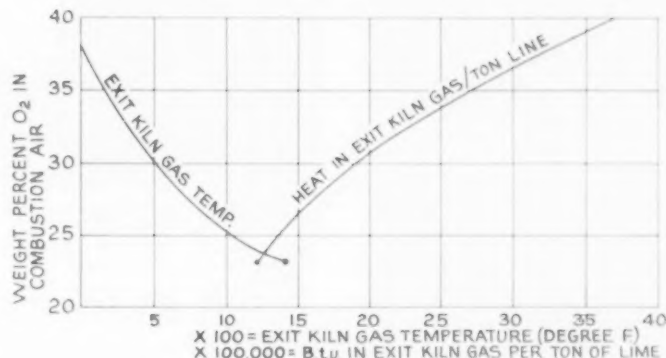


Fig. 3: Effect of increasing available high temperature heat

tem is termed the kiln shell heat loss.

The charge of material in the kiln generally consists of particles of relatively greater or smaller size. On the surface of the charge those particles that are exposed to the hot gases receive heat similarly to the kiln lining: by radiation and convection. The charge in the rotary kiln is rolling, however, so that fresh particles are being brought to the surface and exposed. When the particles are of fairly uniform size, the degree and frequency of exposure is quite uniformly cyclic. When the particles vary extremely in size, the smallest particles are exposed to a lesser degree than the coarsest. Within the particle itself the heat is transferred by conduction from the surface toward the center.

A detailed study of the transfer of heat into the particle of calcium carbonate is extremely complicated. Nor is the problem at all simplified by the fact that above the calcining temperature a coating of lime, which gets thicker and thicker as time goes on, forms on the surface as the lime or zone of calcination penetrates deeper into the particle. Furthermore, the carbon dioxide gas escaping from the zone of active calcination must pass through the layer of lime in a direction opposite to the flow of heat. Thus some of the heat given to the surface of the particle must be used to raise the temperature of the carbon dioxide to the surface temperature of the particle.

It can be understood that the computation of the individual heat transfer rates of the various elements within the kiln would be extremely complicated.

Heat Transfer Rates

It is essential, however, to have some idea of the amount of heat transferred, or the amount of heat transferred in a unit of time if we are to compute not only the productive capacity of the system, but also the optimum physical dimensions of the kiln itself. Even to determine by analysis the behavior of a kiln operation which is under study requires this information. And despite the complications and involvements of this problem, some valuable empirical relations of a practical nature have been derived.

A detailed review and study of the performances of many rotary kiln operations indicates that the overall rate of heat transfer to the load or charge in a properly operated unit will be between 2000 and 8000 B.t.u./hr./sq. ft. of kiln shell surface equivalent. It is amazing to find the rate lower in the kilns of smaller diameter, until it is recalled that this is what was predicted by the study of the features of the simple cylinder.

Another method for determining the overall heat transfer rate of the rotary kiln involves the fundamental relation between the productive capacity of the kiln and its physical dimensions. This relation itself is the

LIME

result of an extended and detailed study of a great number of rotary kiln operations made by the author over a period of years. It was first published in *ROCK PRODUCTS* seven or eight years ago. This particular study resulted in the following empirical relation that holds very closely for most of the kiln sizes found in practice.

$$T_p = \frac{k D L}{100}$$

where T_p is the tons of material produced per day
 D is the kiln shell diameter in feet
 L is the kiln shell length in feet
 k has been termed the production coefficient, usually having a value of 1.0 to 1.5, but this depends upon the type of material being processed, and the manner in which the kiln is operated.

Within its limitations, this relation can be used to determine the overall heat transfer rate, since it holds all the elements required for this purpose. It includes the element of time since it is a time-rate of production. It includes the elements of surface since it holds the physical dimensions of the kiln. It holds also the element of heat quantity since each ton of product represents a fixed quantity of heat that has been usefully applied. It remains only to develop and rearrange the relation into the desired terms.

It will be assumed that the value of k is unity. Thus

$$T_p = \frac{D L}{100} \quad .01 D^2 L$$

From an earlier article the total heat required to preheat, calcine, and superheat the material to produce one ton of lime is about 4,270,000 B.t.u. Then

$$4,270,000 \times T_p = \text{B.t.u./day added to the lime, or}$$

$$4,270,000 \times T_p$$

$$24 \text{ B.t.u./hr. added to the lime.}$$

In order to derive the element of area from the right hand member of the relation, it too must be modified and rearranged. This is done by multiplying by π (3.14) and dividing by D , so that

$$3.14 \times .01 D^2 L = .0314 \times D \times L$$

where $\pi D L$ is the kiln shell surface area.

Both sides of the equation must be multiplied by the same new coefficients, so that

$$4,270,000 \times T_p \times 3.14$$

$$24 \times D$$

$$4,270,000 \times .034 \times D^2 \times L$$

$$24 \times D$$

$$178,000 \times T_p \times \pi = 1780 \times D \times L \times \pi$$

Now $178,000 \times T_p = Q = \text{B.t.u./hr. introduced into the lime, and } 3.14 \times D \times L$ is equal to the kiln shell surface or A_s . We have, then

$$Q \times \pi = 1780 \times A_s$$

$$Q = 1780 \times D \times L$$

$$A_s = \frac{Q}{1780}$$

B.t.u./hr./sq. ft. of kiln shell surface. Here again is that amazing feature, indicating that the overall heat transfer rate per square foot of kiln shell surface increases with the diameter of the kiln shell.

Based on this empirical method for determining the overall rate of heat transfer in the rotary kiln, Table III has been computed for kilns of different diameters.

Table III: Heat transfer rate

Kiln shell diameter, ft.	Q
4	2248
5	2865
6	3492
7	4129
8	4756
9	5383
10	5970
11	6557
12	7144

Fig. 4 illustrates the relation pictorially.

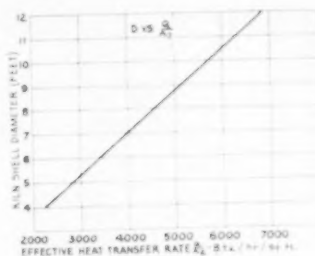


Fig. 4: Heat transfer rate per sq. ft. of kiln shell surface

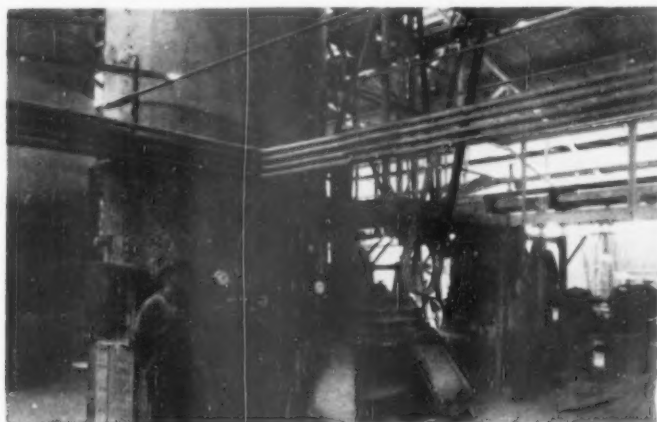
This confirms our previous findings which indicated the desirability of designing the kiln so as to have the greatest feasible diameter. But before we rush into this question of rotary kiln design rashly, let us check these conclusions by other methods that may be available. We must remember that our relations used in these derivations are purely empirical and may have limitations beyond which they are invalid. This subject of heat transfer rate is of such importance that it justifies any amount of time that might be required in its study. Thus, the matter will be developed with its many ramifications in the next article.



Slag Company Exhibits at Rail Show

GRANITE CITY SLAG CO., Granite City, Ill., and its subsidiary, Gary Slag Co., displayed this booth at the equipment exhibition held in conjunction with the Track Supply Association and Bridge and Building Supply Men's Association. R. N. McBowen, president of the slag company, stated there

is a trend to the use of slag as ballast because it does not pump and does not dust like limestone. These advantages, as well as the use of fines for station platforms, were stressed in the display. Interest in the booth was stimulated by letters previously sent to 598 railroad engineers.



Feed (or top) end of kiln, showing continuation of central chute, observation platform, briquette machine (right), table feeder, oil pipe lines and measuring devices; kiln stack is just left of center



Central chute of kiln with briquette feeder

Burning Cement in Shaft Kilns

European plants have successfully adapted shaft kilns for cement manufacture; thermal efficiency and general operation compare favorably with performance of rotary kilns

By DR. STEVEN GOTTLIEB*

IN RECENT YEARS many opinions have been expressed on the suitability of vertical (shaft) kilns for cement manufacture, and there also has been much propaganda on this subject which, however, has not always been sufficiently supported by facts. I have spent most of my life in the study of this subject and think it of such importance to the future of the cement industry that it is worth a comprehensive and impartial survey based on practical experience with recent installations.

The old shaft kiln was practically discarded as obsolete by the cement industry some 30 years ago. Many kilns, however, were continued in operation on the European Continent due to their good thermal efficiencies, even though operation of these kilns could hardly be regarded as up-to-date. The quality of clinker has been far from faultless, manual labor could not be satisfactorily reduced due to the necessity of frequent poking, and operation has not been as clean and fully mechanized as in most rotary kilns.

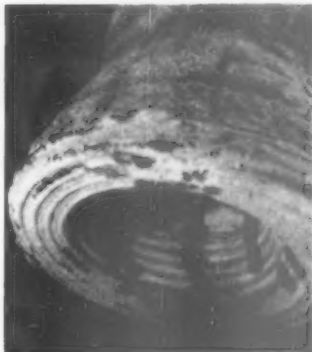
*Queensland Cement and Lime Co., Darra-Brisbane, Queensland, Australia

Fundamentally there is no reason to discard the vertical kiln as was done by the cement industry in the U. K. and U. S. A., because the shaft kiln must be considered in the light of modern developments.

Heat Transfer Possibilities

If we compare the thermal processes of a vertical kiln to those of a rotary kiln, we are forced to the conclusion that the possibilities for improving heat transfer are incomparably greater in a vertical kiln. In the rotary kiln we seem to have reached the possible maximum efficiency with all the ingenuity exercised in the various attempts to promote intimate mixture of the material and gases. However, this is only possible in the lower temperature range, so it is mostly only "low-grade" heat that is regained. In a rotary kiln, heat is transferred from the flame to the relatively small surface presented by the material, mainly by radiation which increases with the fourth power of absolute temperature.

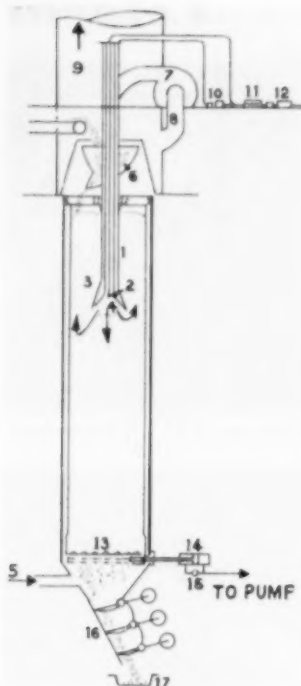
Therefore, much more heat is radiated from the flame than the small material surface presented would be



Bottom end of central chute showing seamless pipe welded into bell shaped end, and oil atomizer in the center

able to absorb. In order to regain part of this heat, rotary kilns must be built to great length or part of the preheating must be done by a more efficient method of heat transfer. It may be done by a Lepol grate, by screw or by blade-type lifters of the type introduced successfully by Dr. Gygi in several up-to-date semi-dry process rotary kiln plants in Switzerland using nodulized feed with 10-12 percent water with considerably reduced kiln lengths. It is a great advantage of the rotary kiln that the material is continually agitated in the hot zone, producing excellent uniformity of size and quality.

The heat transfer possibilities in a vertical kiln are far from being utilized fully, and great possibilities for improvements still exist. If small-size briquettes or nodules are fed into a vertical kiln, providing great active surface, the convective heat transfer rate is very good. We should remember that heat transfer rate by convection increases almost with the square of velocity, and that friction varies as the square of velocity if the



Sectional elevation of shaft kiln for cement manufacture. Numbers refer to the following: 1) refractory-covered shaft, 2) oil burner, 3) water pipes, 14) vaporizing chamber, 15) secondary air inlet, 6) rotating feeder for granules, 7) primary air fan, 8) flue gas pipe, 9) chimney, 10) centrifugal pump, 11) heat exchanger oil water, 12) oil pump, 13) discharging grate, 14) cylinder, 15) valve, 16) alternately opening discharge gates, 17) shuffle conveyor

density remains constant. Small size bodies therefore mean high gas velocities within the voids of the charge, as well as high friction losses.

This means, practically, that in a vertical kiln, using small size nodules as feed, a temperature drop from clinkering to exit gas temperature (approx. 2600 deg. F.—200 deg. F.) can be achieved with a kiln length of about 6 ft., whereas for the same temperature drop, 230 ft. would be required in a wet process, and 150 ft. in a semi-dry process rotary kiln of corresponding outputs.

Problems Encountered

However, with the improvement of the heat transfer rate, many problems present themselves as seemingly insurmountable difficulties. The first and most important difficulty is the problem of uniform gas flow. In a vertical kiln, the shaft is filled with material which contains moisture in the upper levels. The material is dried and calcined and finally sintered. During these stages, the material moves with different speeds toward the discharge

grate and its resistance to gas flow also varies correspondingly; this, in turn, affects gas distribution. The very incomplete movement through a vertical kiln, where the hot zone material is agitated only by the slow motions of a discharging grate at a considerable distance from it, is in sharp contrast to the almost perfect movement obtained by rotating the material in the hot zone of a rotary kiln.

The "Wall-Effect"

In a mixed-feed kiln the amount of coal or coke is proportioned equally throughout the whole cross section of the kiln, whereas the center retains more heat, due to better insulation, than the material near the wall. On the other hand, the center of the material charge in a vertical kiln shaft tends to move more quickly than the material near the wall. Besides, the "wall-effect," i.e., the lower resistance of the material near the wall against gas flow, must also be considered. The result is the diversion of the greater part of the gas flow to the wall, resulting in an excess of air. On the other hand there is deficiency of air, i.e. appreciable amounts of carbon monoxide in the center of the kiln.

Much improvement has been achieved in recent years toward correcting these deficiencies. In a large Middle-East plant a battery of six kilns could be raised to higher working efficiency than that of an adjoining modern wet process rotary kiln plant, and practically the same quality of cement would be produced from both types of kilns. This would not be true in all cases. The quality of the raw materials, their burnability and the water consumed to attain a suitable plasticity, are very important and are variable factors in each case. Shaft kilns are much more sensitive than rotary kilns to variations in the quality of raw materials, affecting their efficiency and the quality of clinker. Therefore, a fair comparison of modern shaft kilns vs. rotary kilns at this stage of development is only possible with certain types of raw materials.

Swiss Shaft Kilns

However, if materials of suitable plasticity are available, there is no reason why the modern shaft kiln should not be competitive with the most efficient rotary kiln types. Quite

recently I participated in the design, construction and placing in operation of an up-to-date shaft kiln plant in Switzerland. These kilns are 40-ft. high with 8-ft. diameters in their upper halves. Sliding-type hydraulically operated discharge equipment was used. The raw material is fed into these kilns in the forms of nodules with 10-12 percent of water and the fan has to deliver the necessary amount of air against a pressure of 70 in. W.G. A new type of nodulizer has proved to be very successful. Without a wet screw conveyor and the accompanying dust nuisance, nodulizing is done in one operation from the dry raw mix near the top of the kiln. Several more plants have adopted this type of nodulizer in Switzerland. A similar nodulizer was previously in operation in a plant in Czechoslovakia.

It was possible to burn good quality clinker in the Swiss plant without any signs of reduction with 1-2 percent of excess air only. "Spinella" type refractories (General Refractories, Sheffield) proved to be very satisfactory. The kilns are operating fully automatically with centralized kiln controls, similar to those for rotary kilns. The kilns are equipped with electrostatic dust precipitators, (Osiki), but due to the excellent heat economy of approximately 590,000 B.t.u. per bbl. of clinker during the first weeks of operation, the exit gas temperature dropped so low that frequent trouble has resulted due to moisture condensation in the dust precipitation chambers.

These kilns were planned for oil firing, but due to the great increase in the price of oil in Switzerland, it was decided to adapt the new kilns for alternate oil or coke firing, and at present they are operating on coke breeze.

Kiln Firing

The use of small regular nodules in a vertical kiln opened new possibilities for direct, as well as for indirect (mixed feed) firing. In the case of cement clinker, fuel consumption could be reduced to levels which were regarded as impossible not long ago. There are, however, a series of factors which must be considered carefully when putting such a kiln into operation, or smooth and fully automatic operation may quickly change to operating difficulties, necessitating day and night attention to correct a long



Nodulizer in which briquettes of raw material are made

chain of troubles. One of these factors, requiring particular attention, is the discharge of clinker. Due to the slow downward movement of the material in a vertical kiln, the sintered nodules tend to agglomerate, thus producing large blocks, particularly in the center of the kiln. This is because the faster movement of the center cannot overcome the effect of the higher temperature due to its increased insulation. The blocks thus formed must be broken up by the discharge grate so as to provide for uniform settlement of the kiln charge. The principal discharge equipment used for modern kilns are either the rotary or the sliding type grates with suitably adjusted opening sizes, and three alternately opening and closing gates to allow the clinker to pass out of the kiln without undue loss of air pressure and dust.

Even the most desirable design of discharge equipment will conform with the above requirement of uniform settlement only if the material has passed through an unbroken hot zone, i.e., if no insufficiently burned material can enter the area below the hot zone. If, due to uneven gas flow, parts of the hot zone will cool down to such a degree that the material passing it becomes insufficiently clinkered, the result will be an acceleration of flow through the "weak gaps" and uneven flow through the grate, leading inevitably to breakdowns, since more and more coal or coke in the raw mix will pass these gaps without ignition.

Modern kilns with high outputs, reaching up to 200 t.p.d., and using small-sized feed, are of course much more sensitive to any change of gas flow, as in the proportioning of coal and the discharge of clinker.

Controlling Material Flow

A new concept in vertical kiln practice has been introduced by using a central blow-in chute, reaching from the top of the kiln towards its center, as shown in the accompanying drawing. The chute is covered with fire-brick and widened at its bottom end to serve as a baffle in the center of the kiln, in order to prevent too speedy movement of the material before it reaches the firing zone. The use of the central chute made it possible to operate the vertical kiln with liquid or gaseous fuels. The accompanying sketch shows an installation for liquid fuel, with a pressure-type oil atomizer situated in the lower, bell-shaped end of the chute. This bell-shaped chute-end was made of seamless steel piping in which water is circulated by a small centrifugal pump for cooling as well as for indicating the temperature in the hot zone. The outlet temperature of this circulating water was kept between 75-80 deg. C. The circulating water was also used for oil-preheating. Within the small space between the bell and the natural slope of the downward moving material, a minor part of the fuel is burned and, through the heat thereby generated,

Calculation of heat transfer rates at a controlled production test at average output

a) Clinker per minute	165.7 lb.
b) Fuel-oil (masut) per minute	19.8 lb.
c) Fuel-oil (masut) per 100 lb. clinker	12.8 lb.
d) Air required per lb. of fuel	13.6 lb.
e) Excess air used in kiln	12.0 %
f) Moisture in raw material briquettes	17.0 %
g) CaCO ₃ from raw material per 100 lb. clinker	113.2 lb.
h) CO ₂ from raw material per 100 lb. clinker	500 lb.
i) Temperature of exit gases just above material surface	500 deg. F.
j) Temperature of clinker leaving kiln	500 deg. F.
k) Calorific value of masut (lower value)	17,400 B.t.u./lb.

Heat content of the kiln gases at 500 deg. F.

	Weight of gas per lb. of oil	Heat content per lb. of gas per deg. F.	Total heat content of gas per lb. of oil
CO ₂	7.1	97	688
H ₂ O	3.06	141	432
SO ₂	0.06	100	6
N ₂	10.47	110	1150
excess air	1.63	106	173
	22.32		2449 B.t.u./lb. of oil

Total heat balance of the kiln with 12 percent excess air

Heat loss in exit gases	2,449 B.t.u.
Moisture of briquettes	2,449 B.t.u.
Dust loss	24 B.t.u.
Decomposition of CaCO ₃ minus heat from exothermic reaction	7,055 B.t.u.
Heat loss cooling water	164 B.t.u.
Heat loss in clinker	960 B.t.u.
Radiation from kiln shell and other losses	4,308 B.t.u.
	17,400 B.t.u./lb. oil

Heat supplied to the combustion zone:

By the oil as fired	17,400 B.t.u.
By secondary air passing through the cooler	1,767 B.t.u.
	19,167 B.t.u./lb. oil

Heat is expended as follows:

Raising the temp. of products of combustion	15,820 B.t.u.
Raising the temp. CO ₂ from the material	810 B.t.u.
Heat available for radiant transfer	2,507 B.t.u.

The main transfer of heat, however, will not be by radiation but by the heat content of the gases by convection to the large surface as presented by the material. This will be in three typical temperature stages as follows.

Temperature Stages

	a at 1225 deg. F.	b at 1800 deg. F.	c at 2500 deg. F.
Products of combustion	7,190	10,950	15,820
CO ₂ from raw material	1,050	1,670	2,440
Steam from moisture	3,499	4,273	5,045

Space filled by raw material briquettes:

Volume of interstices to be filled by gas in upper part of kiln	249 cu. ft.
Mean volume of gas passing through upper part of kiln per second	60 cu. ft.
Time required for gas to pass through interstices	4.15 sec.

Heat transferred by convection:

$$Q = \int_{dT_1}^{dT_2} H \cdot F \cdot dT$$

H = convection heat transfer coefficient
F = material surface

Due to the difficulty of calculating the rapidly changing temperature differences between gas and material, the logarithmic mean was calculated:

$$T_1 = \text{gas-mat. } 2500 - 2450 = 50 \text{ deg. F.}$$

$$T_2 = \text{gas-mat. } 1800 - 300 = 1500 \text{ deg. F.}$$

thus the log mean

$$M = \frac{1500 - 50}{2.3 \log \frac{1500}{50}} = 428 \text{ deg. F.}$$

For the calculation of the H. Schack's formula was used:

$$H = \frac{V}{D \cdot 0.31} = 6$$

and the average heat transfer rate by convection = 248,000 B.t.u./min.

Actual measurements of temperature in the hot zone were carried out by carborundum rods with Seger cones placed into their tips. Based on these figures the rate of transfer was higher, or 346,000 B.t.u./min.

(Continued on page 136)

Crushing Practice and Theory

Part III. Operating characteristics of various types of crushers

By BROWNELL MCGREW*

IN OUR DISCUSSIONS of the operating characteristics of the various crusher types we shall avoid, as far as possible, burdening the reader with mechanical details, which are covered quite thoroughly in catalogues and bulletins printed for that purpose. A brief general description of the essential features of each type will serve to clarify the action, for those who are not familiar with crushing equipment.

Fig. 1 shows a sectional view of a typical gyratory crusher. This type of machine is, by virtue of chronological priority, known as the "standard" gyratory crusher. Although it incorporates many refinements in design, it is fundamentally the same crusher that first bore the name of "gyratory"; its crushing chamber is very much the same shape; the motion is identically the same, and the method of transmitting power from belt to crushing head is similar. It is an interesting fact that the same similarity in essential features of design exists in the case of the "standard," or Blake type, jaw crusher, which is something in the way of a tribute to the inspiration and mechanical ability of the men who originated these machines.

Essentially, the gyratory crusher consists of a heavy cast-iron, or steel, frame which includes in its lower part an actuating mechanism (eccentric and driving gears), and in its upper part a cone-shaped crushing chamber, lined with wear-resisting plates (concaves). Spanning the crushing chamber across its top is a steady-rest (spider), containing a machined journal which fixes the position of the upper end of the mainshaft. The active crushing member consists of the mainshaft and its crushing head, or head-center and mantle. This assembly is suspended in the spider journal by means of a heavy nut which, in all but the very large machines, is arranged for a certain amount of vertical adjustment of the shaft and head. At its lower end the mainshaft passes through the babbitted eccentric journal, which offsets the lower end of the shaft with respect to the centerline of the crusher. Thus, when the eccentric is rotated by its gear train, the lower end of the mainshaft is caused to gyrate (oscillate) in a small circular

path), and the crushing head, likewise, gyrates within the crushing chamber, progressively approaching, and receding from, each element of the cone-shaped inner surface.

The action of the gyratory crusher, and of the other member of the reciprocating pressure family, the jaw crusher, is fundamentally a simple one, but as will be seen a great deal of thought and some very progressive engineering has been expended upon the design of crushing chambers to increase capacities and to permit the use of closer discharge settings for secondary and fine-reduction crushing.

Referring to the table, always available from the manufacturer,

must necessarily be of massive and rigid proportions, rigidity being of equal importance to ultimate strength. Regardless of the tensile strength of the metal used in the main frame, top shell, and spider, these parts must be made with walls and ribs thick enough to provide this rigidity. Therefore it is practicable to use close-grained cast iron, and special high-test mixtures of cast iron, for these parts, if the machine is intended for crushing soft or medium materials. When very hard and tough materials are to be crushed, the machine is usually strengthened by substituting cast steel in one or more of its parts.

Wearing parts in the gyratory crusher may be either chilled cast iron or manganese steel, depending on the character of the material to be crushed and the particular class of service for which the machine is intended. Standard crushers, in the small and medium sizes, are customarily fitted with chilled-iron head and concaves for crushing soft and medium limestone and materials of similar hardness and abrasiveness, because its relatively low first cost and excellent wearing qualities make it the most economical material to use when the service is not too severe. Manganese steel, which combines extreme toughness with unsurpassed wear-resistance, is the universal choice for crushing hard, tough rock regardless of the class of service or type of crusher. Even though the rock be quite soft and non-abrasive, it is general practice to use manganese steel concaves in the larger sizes of primary crushers because of the shocks attendant upon handling large and heavy pieces of rock.

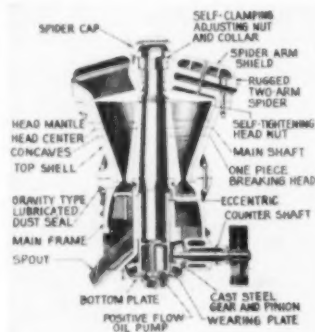


Fig. 1: Sectional view of a typical "standard" gyratory crusher

it will be noted that standard gyratory crushers are manufactured in commercial sizes ranging from 8 in. to 60 in. receiving openings. Capacities are listed, for minimum and maximum open-side discharge settings, in short tons per hour, and the horsepower requirements for soft and hard materials are listed for each size. The capacities, and the minimum settings, are based upon the use of standard (straight-face) concaves.

Rigidity Prime Essential

To stand up under the extremely rugged work of reducing hard and tough rock and ore, and in doing so to maintain reasonably true alignment of its running parts, the crusher

Straight-Face Concaves

When used for primary or coarse secondary crushing service, the type of crusher we have been describing is usually fitted with the style of concave shown in Fig. 2. These are known as "standard" or straight-face concaves, which have been the standard type of liner ever since the gyratory crusher came into popular use. The distinguishing features of this type of concave are:

- (1) The receiving opening, for any given size of crusher, is at a maximum.
- (2) The choke-point (point of mini-

*Allis-Chalmers Manufacturing Co., Los Angeles, Calif., district office.

imum capacity) is at the discharge opening.

- (3) The ratio of reduction varies for different sizes, ranging from about 5.35 to 7.6, and averaging about 6.1 for all sizes from 8 in. to 42 in. inclusive. These ratios are based upon the use of standard-throw eccentrics.

Usually the primary crusher is selected on the basis of (1) size of receiving opening and (2) capacity. More often than not, the gyratory crusher with sufficiently large receiving opening will have ample capacity for the job. Furthermore, the permissible minimum discharge setting for the standard gyratory is usually small enough to make an acceptable secondary feed. For these reasons the standard crusher is, as stated before, usually supplied with straight-face concaves for primary crushing service.

There are some secondary crushing applications where maximum receiving opening, for any given size of machine, is desirable. For such applications straight-face concaves are indicated, provided of course that the crusher so fitted will have sufficient capacity for the job in hand. On the other hand, most secondary—and some primary—crushing jobs require maximum capacity and maximum ratio of reduction, rather than maximum receiving opening. The standard gyratory crusher has been adapted for such applications by the introduction of an interesting and important change in the shape of its crushing chamber, regarding which we shall have more to say under the subject of "non-choking concaves."

There are of course certain limiting factors which govern the proportions of the crushing chamber in these standard gyratory machines. One of these, the ratio of reduction which can safely be made in any given machine, has already been mentioned. As the ratio of reduction is simply the ratio of receiving opening to discharge opening, it follows that this limitation is directly related to the safe minimum discharge setting. All crusher manufacturers establish what are considered to be safe minimum settings for the different sizes of crushers of their manufacture. Published capacity tables for gyratory and jaw crushers generally list capacities at settings down to and including these minimum openings. The practice for gyratory crushers is to predicate these minimum settings upon the use of standard-throw eccentrics; i.e., throws which experience has proven to be right for each particular size of crusher.

Crusher Settings

The actual minimum safe setting will vary somewhat, for any given machine, depending upon the character of the material, the amount of fines in the feed, and whether the crusher is being operated under choke-feed or

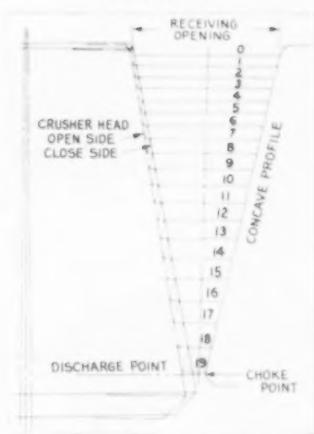


Fig. 2: Section through a vertical plane in the crushing chamber of a gyratory crusher

regulated feed conditions. It is possible, when all conditions are favorable, to operate gyratory crushers, with standard throw eccentrics, at smaller discharge settings than are indicated by the published tables. Generally speaking, however, it cannot be considered good practice to do so; and any experimentation along these lines should be accompanied by a close check on the power consumption, to make sure that the crusher is not being overloaded.

When it is necessary, or desirable, to operate a gyratory crusher at discharge settings below the minimum standard, the safe practice is to fit the machine with a reduced throw eccentric. The crusher manufacturer will be able to advise the operator about these special throws for machines of his make.

If a reduced throw eccentric is installed, the capacity at any given setting will drop off approximately in direct proportion to the reduction in throw. In some cases it is possible to compensate, partially at least, for this drop-off by speeding up the machine. Here, again, the manufacturer will be able to advise the operator as to the maximum safe speed for any particular crusher of his line.

Another factor which governs the proportions of the crushing chamber is the maximum permissible angle between the two crushing faces. This also is subject to a certain amount of variation, depending upon the character of the material, and upon the size of the machine. Crushing angles may vary between the approximate limits of 22 and 30 deg. in a line of standard gyratory crushers. It is possible to use larger angles in the larger sizes of crushers because the greater weight of the individual pieces of material tends to minimize slipping. Furthermore, in these large machines, a difference of a few degrees in the

crushing angle makes a considerable difference in the height, weight, and cost of the crusher.

It is obvious that the coefficient of friction of the material to be crushed has a very direct bearing upon the maximum permissible crushing angle. Some slippery materials, even though quite soft, require special reduced-angle crushing chambers. In the standard gyratory crusher this is accomplished very simply by increasing the thickness of the concaves at the top, and tapering them down toward the discharge; in the jaw crusher the change is generally made by inserting a wedge-shaped filler behind the liner plates on the movable jaw.

For a given coefficient of friction, the harder the material is, the smaller will be the maximum permissible crushing angle. Extremely hard, tough materials even though their coefficient of friction be fairly high may require special reduced crushing angles to prevent excessive slipping. Anyone who has seen hard granite boulders shoot out of a gyratory or jaw crusher, or has watched a wide-angle crusher at work on hard granite or trap rock, has had a visual demonstration of this physical fact.

A certain amount of slippage occurs in all pressure type crushers, regardless of how small the crushing angle may be (that is, within practicable design limits), especially in the lower part of the crushing chamber where the pieces are smaller and lighter. Under normal operating conditions this tendency is counteracted by the weight of material in the upper part of the chamber. Another method of compensation is to "break" the angle of the lower tier of concaves to provide a more favorable crushing angle in this zone.

Crushing Action

Fig. 2, showing the "standard gyratory with straight concaves," is a section through any vertical, radial plane in the crushing chamber of one of the intermediate sizes of the crusher. In order to understand the crushing action in such a chamber it is helpful to consider the process as though each step took place in an orderly, and "ideal" fashion. It is hardly necessary to add that the action never does take place in just that fashion; nevertheless the concept is fundamentally a correct one, and the average performance of the crusher follows the pattern so closely that it is possible to predict, within surprisingly close limits, what any particular design of crusher will do.

We start out by visualizing the crushing chamber filled with a tractable material which will act just the way we want it to, with a head of material (choke-feed) above the receiving opening so that no un-sure of load will occur during the closing stroke of the crusher head. Now, con-

(Continued on page 131)



View of new precipitator installed in 1949 at a cost of \$185,000



Old dust collector installation

Calaveras' Dust Damage Suit

By DR. OLIVER BOWLES*

A COURT CASE THAT came to trial in April, 1949, involving claims for damages because of cement dust, is of interest not only to cement manufacturers, but to all mineral producers that have dust problems. At the recent meeting of the American Institute of Mining and Metallurgical Engineers in New York City, William Wallace Mein, Jr., a director of the Calaveras Cement Co., San Francisco, Calif., described the claims made against the company for dust damage, the procedure followed in the trial, and the decisions of the court. The following discussion is in part an abstract of Mr. Mein's paper entitled "The Recent Calaveras Cement Co. Dust Suit" published by the Institute.

The cement plant is situated near San Andreas, about 45 miles east of Stockton, Calif. It began production in 1926, and during the period 1929 to 1938 the company paid dust damages totaling \$27,000. A 2-unit Cottrell electric precipitator installed in 1928 collected over 85 percent of the dust made by the two kilns then in operation, and no further damage claims were registered until 1946. In that year an additional kiln, much larger than the two previously in use, began operation, and as the dust-collecting equipment was inadequate to take care of the additional load, escaping dust led to new claims for damages. Because of post-war material shortages new dust-collecting equipment could not be added at that time, and the company



Location of the plant in relation to the plaintiffs

offered to pay reasonable damage claims until such time as a new dust collector could be built. The landowners, however, put in claims for total damages amounting to \$120,000. As such claims seemed unreasonable to the company, no settlement was made, and suit was filed in the Superior Court of Calaveras County.

Case for the Five Ranchers

The attorneys for the plaintiffs called witnesses to establish that flue dust damaged the land and forage, caused fluorine poisoning of animals, and interfered with comfortable use and enjoyment of their properties. Soil chemists testified that soil samples from dust-laden areas showed pH values generally above 8.0, indicating an alkalinity high enough to cause soil sterility. Veterinarians testified that

cattle grazing on the dust area showed definite symptoms of fluorine poisoning. Thus they claimed that because forage was inadequate they had to cut the size of their herds, and because of fluorine poisoning their cattle were not marketable beef. It was their contention that damages should be large enough to represent a capitalization of all profits. In addition, further claims were made for nuisance and inconvenience from dust on food, clothing and in the home.

Case for the Cement Company

The company's line-up of witnesses was similar to that of the plaintiffs—veterinarians, chemists and soil analysts. In general, the evidence presented was diametrically opposite to that of the plaintiffs. Soil samples from dust-laden areas indicated a neutral pH value, 7.13 to an extreme high of 7.85. An agronomist testified that the heaviest growth of clover and other choice grasses was in areas of heaviest dust precipitation. Hence it appeared that the operation of the cement plant had caused no damage to the soil either on the basis of plant growth or chemical analysis, although forage crops were dust laden and less palatable in the dry seasons.

The most serious claim, that of fluorine poisoning, caught the company unaware, and intensive study was demanded. Grass samples taken at the landowners' gauging stations sent to the Twining Laboratories at Fresno showed only 3.8, 9.5 and 13.3 parts of fluorine per million, whereas samples taken 15 miles away showed a much higher percentage. Similarly, soil samples from a point 15 miles away contained 59.5 parts per million of fluorine as against an average of only 7.8 parts per million in samples taken underneath the three gauging stations. A toxicologist testified that an animal would have to consume fifteen

*Retired, U. S. Bureau of Mines

times its normal intake of 30 lb. of food per day to obtain a toxic quantity of fluorine, namely, 200 parts per million. Furthermore, the Twining Laboratory chemist pointed out that fluorine in cement plant flue dust is in the form of calcium fluoride which has a solubility so low as to make it virtually ineffective. The poor condition of the animals said to be caused by fluorine was, according to company witnesses, due to "old age, lice, and an adverse winter."

Verdict and Injunction

The jury consisting of 6 men and 6 women, most of them local ranchers and housewives, rendered a verdict awarding the plaintiffs a total of \$7508 for damages instead of the \$120,000 for which they sued.

Although this verdict was reasonably favorable to the company, it represented only half of the suit. The

plaintiffs also asked for an injunction forbidding the company to cast dust upon their properties in injurious quantities. The judge announced that he alone would decide upon the injunction. Each side presented its case, and the judge requested each side to prepare what it considered a proper order. The cement company presented a proposed order stipulating that it must recover not less than 87 percent of all dust which would be discharged from the kilns in the absence of any control. The plaintiffs proposed an order permanently enjoining the company from operating in such a manner as to cause injury to the soil, vegetation, cattle or homes of the five plaintiffs. The order and injunction adopted by the judge were virtually in accord with the draft submitted by the company. The injunction is explicit and can easily be checked, whereas the loose wording of the order pro-

posed by the landowners would have permitted continual harassment of the company with new claims for damages. The plaintiffs have filed an appeal.

A few days prior to June 30, the grace period, a new precipitator was placed in operation, and it is claimed that there will be no difficulty in collecting 87 percent of the flue dust discharge.

Dust is expensive. It was brought out during discussion of this paper that the investment in the new precipitator amounted to about \$185,000, and that it would cost \$47,000 a year to operate it. As an amusing side light it was also brought out in discussion that in one instance when a company had been enjoined to put in dust collectors because of dust damage to farm lands, the dust collected was later sold to the farmers for land improvement.

Nomograms Show Hydrated Lime Composition

NOMOGRAMS DEVELOPED BY ERNEST M. LEVIN of the National Bureau of Standards simplify computation of the compounds that are present in hydrated limes. Knowledge of these compounds has become important in the selection of limes to be used in white coat plasters. Plaster containing some unhydrated material (MgO) at the time of application continues to hydrate slowly after the plaster has set, eventually causing disruptive expansion. Methods were developed at the Bureau for determining the percentage of unhydrated material remaining in a hydrated lime. An 8 percent limit

Procedure	Percent
CO ₂	0.70
CaO	72.60
Combined H ₂ O	23.06
Total MgO	1.04

Subtotal

1. Locate line ab (CO₂, percent to CaO, percent):

At right of (a) read CaCO₃ 1.6
At (c) read Ca(OH)₂ 95.0

2. Locate line cd (Ca(OH)₂, percent to combined H₂O, percent) and extend to (e) (hydrated MgO, percent):

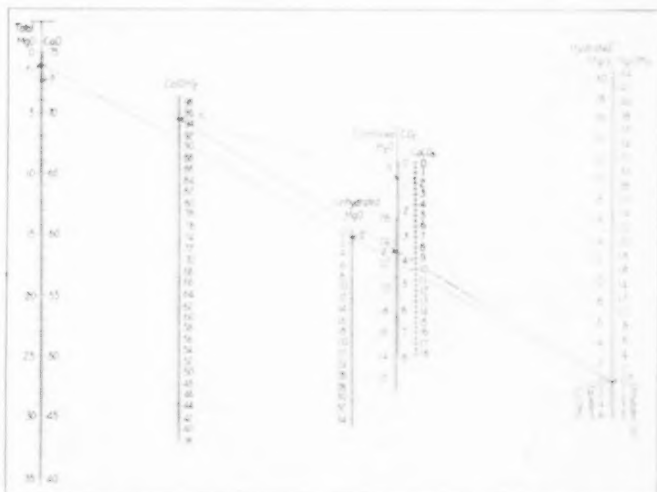
At (e) read Mg(OH)₂ 0.9

3. Locate line of (Mg(OH)₂, percent to total MgO, percent):

At (g) read unhydrated MgO 1.0

Subtotal

Essential oxide analysis



Example of the procedure for using the nomograms to obtain the compound composition of a hydrated lime

on unhydrated oxides was adopted as a tentative amendment to Federal Specifications for Hydrated Lime, and the same limit was included recently in specifications of the American Society for Testing Materials and in those of the American Standards Association.

Determination of the composition of hydrated limes, particularly the unhydrated oxide content, is of obvious

importance both to the manufacturer and to the prospective purchaser. The actual computation of the compound composition is made from the chemical (oxide) analysis and requires about nine mathematical operations of addition, subtraction and multiplication. In order to save the time and labor involved in these calculations, two nomograms have been constructed for making the computations graphically.

Tailings



Looking across the tailing pond from the slime area of Castle Dome; the trestle disappears, right, and goes over the hill towards mill

CONTROL OF TAILINGS FROM WASHING PLANTS

Part III. Castle Dome Copper Co., Inc., employs tailing control methods to meet unusual situation. Here is an excellent example of type of dike and pond where berm is kept level and pipe line serving it slopes and is kept inside the berm

OPERATIONS OF THE Castle Dome Copper Co., Inc., are a few miles west of Miami, Ariz. The mine is served by a paved road and can be reached easily from the Globe-Miami area. The Castle Dome Copper Co., Inc., is a subsidiary of the Miami Copper Co. It is an open pit mine and differs little from conventional quarry operations. Power shovels load to a fleet of trucks, and at times considerable stripping is done.

Crusher Installation

One feature here of general interest, aside from the tailing control methods, is the primary crusher which is mounted underground. The crushed rock is taken from the crusher to the mill bins by a 1020-ft. (center to center) 48-in. inclined belt. The crusher is a 66 x 84-in. Allis-Chalmers jaw, one of the largest crushers of its type in the world. By having the crusher well underground, it can be under and adjacent to the open pit; thus it is in no danger from blasting. Trucking to such an installation can be uphill, downhill, or on level grades, and large pockets provided ahead of the crusher for considerable rock storage purposes. The crusher here is so placed that a repair truck can drive underground to it.

Tailing Methods

The tailing control methods at the Castle Dome mine have developed a technique that is quite unique. The practices have developed because of an unusual situation, and have been

By **WALTER B. LENHART**

amplified by more recent experiences that stemmed from a break in the sand dike that was used to retain the tailings.

The mill at the Castle Dome mine was built during the last World War and up to January 1, 1950, some 25,188,000 tons of tailings had gone into the dam. Current operations are 4,000,000 tons per year, or 12,000 tons per 24-hr. day. The dike holding back this large tonnage of slime and sand is made up entirely of the solids in the pulp from the mill. It is an excellent example of the type of dike and pond where the berm is kept level and the pipe line serving it slopes and is kept inside the berm. The trestle supporting the pipe line carrying the pulp to the pond is up to 50 ft. high at its highest point; the posts are 4 x 4 in. and the entire assembly is well built and serviceable. Walkways and ample night lights are provided.

Tailings are controlled here because of state laws. Drainage is towards the lake behind Roosevelt dam. As water is scarce it is also desirable to reclaim and reuse as much of the water in the pulp as is possible.

While this is a large operation and the tonnage and volume going to the pond is large, the tailing control techniques still can be studied and possibly used by our rock products industries. Where tonnages going to a tailing pond might be smaller, one might

use the same methods as at Castle Dome but on a smaller scale. Because of the extreme amount of study that the engineering staffs of both the Castle Dome Copper Co., Inc., and the parent company, the Miami Copper Co., put into the tailing pond design, we wish to place some emphasis on the techniques developed, for from them one may by-pass troubles in the years to come.

Necessity for Reclaiming Water

New, or primary, water for the Castle Dome mine has to be pumped 11 miles, so reclaiming from the system is essential. Altogether, 80.4 percent of the water used is reclaimed either from the pond or from the thickeners ahead of the pond. The tailing pond accounts for 51.5 percent of the total reclaimed and the thickeners account for the remainder.

In the recovery of copper, the ore is first ground in ball mills in closed circuit with classifiers and the copper sulfides are recovered by flotation. The rejects or tailings from the flotation mill flow by gravity to the thickeners.

There are two Dorr thickeners, each 225 ft. in diameter. Ahead of these two thickeners is a 30-ft. dia. Dorr hydroseparator that was installed to take out some of the coarser solids and thus relieve the strains on the torque-type thickeners. The underflow from the hydroseparator and from the two larger thickeners all join and flow by gravity to the tailing pond through an 18-in. dia. steel-banded, redwood pipe that has a total length



of about $3\frac{1}{2}$ miles. It has a slope of 0.8 percent and carries a pulp containing 48 percent solids.

Controlling Thickener Underflow

The clear water from the two thickeners is pumped back to the mill by a battery of four 2000-g.p.m. pumps. A man is stationed at the thickeners who also looks after the pumps. At frequent intervals this operator takes a sample of the pulp from the thickeners and weighs up one liter (1000 c.c.) of it; from the net weight in grams he can get the specific gravity of the pulp. A table is available from which he can read the percent solids in the pulp, and by adjusting the thickener's underflow, he can keep the pulp at the 48 percent figure (1.480 sp. gr.). This figure means a buoyant pulp which will not sand up the pipe line, though a thick pulp can mean less wear on the pipe lines. Although wear on the pipe line is not important from experience of the parent company, the Miami Copper Co. indicates that the redwood pipe line will last for 20 years or more of continuous service with this type of material. However, the big problem here is to recover clear water close to the mill and at a relatively low hydrostatic head, for water pumped back from the clear water part of the tailing pond has to be lifted about 165 ft. and pumped a total distance of roughly $3\frac{1}{2}$ miles.

The pulp from the mill and going to the hydroseparator has the following screen analysis:

Plus 48-mesh—	14.5 percent
Plus 65-mesh—	15.5 percent
Plus 100-mesh—	13.6 percent
Plus 150-mesh—	9.3 percent
Plus 200-mesh—	8.9 percent
Minus 200-mesh—	38.2 percent
	100.0 percent

The discharge of the 30-ft. hydroseparator is as follows:

Plus 48-mesh—	26.7 percent
Plus 65-mesh—	23.0 percent
Plus 100-mesh—	17.4 percent
Plus 150-mesh—	9.5 percent
Plus 200-mesh—	6.7 percent
Minus 200-mesh—	16.7 percent
	100.0 percent

The overflow from the 30-ft. hydroseparator going to the two 225-ft. thickeners (half to each thickener) is as follows:

Top: One of two 225-ft. thickeners which recover clear water near the Castle Dome mill. In background is belt from underground primary crusher. Center: Flow from thickeners is by gravity, and there is considerable head to the tailing pond. The pulp flows from top, left. Risers are watertight and absorb some of the hydrostatic head. Bottom: Main 14-in. steel decant line that goes down under water line is at left where it follows contour of the hill. Concrete piers keep decant line from floating in a thick pulp. Structure over the clear water is the suction end of a siphon that takes clear water to pumps. The outer end of the siphon can be raised as the water level rises

TAILINGS

Plus 48-mesh—	0.4 percent
Plus 65-mesh—	1.2 percent
Plus 100-mesh—	4.0 percent
Plus 150-mesh—	6.8 percent
Plus 200-mesh—	10.9 percent
Minus 200-mesh—	76.7 percent

100.0 percent

The specific gravity of the solids in the pulp is 2.61. The pulp going to the hydroseparator is 26 percent solids. The ore is a porphyry and the gangue is siliceous material with some feldspar. The pulp has a pH of 11.4 in the mill, where 4 lb. of lime are added per ton of ore. The lime used is purchased locally and has 88 percent CaO. The lime aids in the settling but is not added for that purpose. As the ore is slightly acid the pH of the material by the time it reaches the tailing pond could be slightly less than the figure given above. It is interesting to note in Fig. 1 that adding too much lime to this pulp has a detrimental effect on its settling rate.

Specific Gravity Control

The specific gravity of the pulp from the thickeners is controlled by means of hard rubber discs through which are circular orifices. The diameter of these openings ranges from 2½ to 3½ in. and a wide range of orifices are on hand. If the pulp from a thickener is too thin, an orifice of smaller diameter is inserted in the line so as to slow down the flow of pulp and automatically raise its specific gravity. If the pulp has too high a gravity, an orifice of larger diameter is used.

The underflow of the larger thickener comes out through an 8-in. pipe line via a tunnel under the thickeners. Near the outboard end of that pipe a "T" has been spotted. This "T" is so designed that it can receive the hard rubber orifice where it rests on a suitable seat. The third opening in the "T" is the opening through which the orifice is inserted into its seat. After insertion this third opening in the "T" is closed by an improvised door.

It will be noted from the screen analysis of the various products that the hydroseparator throws less coarse material into the larger thickeners with less likelihood of damage to the thickeners from overloads.

Reducing Hydrostatic Head

The underflows from the hydroseparator and the thickeners join and flow by gravity to the damsite. The total fall is 165 ft., and to absorb some of this hydrostatic head and to prevent putting too much pressure on the redwood pipe line, a series of drop-boxes have been provided. There are three of these vertical risers with the flow of pulp going into the top member. They are watertight and rubber-lined to resist abrasion. The bottom two are each about 40 ft. high. The

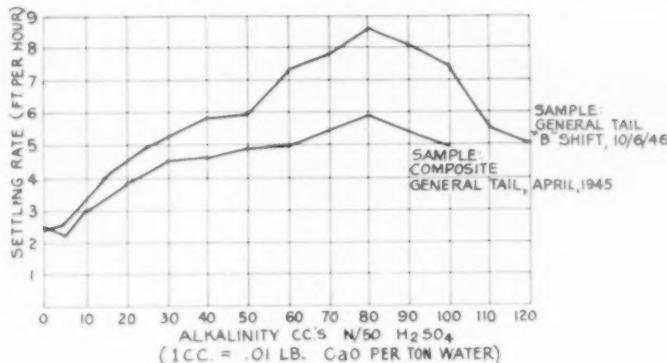


Fig. 1. Effect on settling rate of increased alkalinity

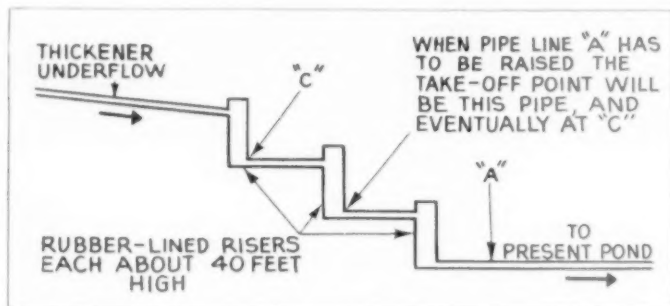


Fig. 2. Risers are so designed and installed that when it becomes necessary to raise the pipe line across the berm, the next upper horizontal connecting pipe is the take-off for the raised pipe line

pulp flows out of the pipe line at the bottom of the lower rectangular riser to the tailing pond by gravity. This part of the pipe line, due to the hydrostatic pressure on it, can be as low as 0.5 percent grade without danger of sanding up. The risers are so designed and installed that when it becomes necessary to raise the pipe line across the berm, the next upper horizontal connecting pipe is the take-off for the raised pipe line (Fig. 2).

The site available for the tailing pond differed quite markedly from that at Miami. At Miami the foundation structure of all the tailing ponds was on an open and porous gravel that was up to 100 ft. thick.

Foundation Structure

At Castle Dome the base structure consists of bedrock. No drainage was possible through it so the engineers built a preliminary dam or dike across a narrow part of the canyon as shown in Fig. 2. Near the toe of the upstream face of this dike a porous footing was provided. A 14-in. cast iron bell and spigot pipe was placed under this porous section and extended on across and through the base of the preliminary dam. After a considerable amount of sand was placed over the inlet of the 14-in. drain pipe, the valve

at its downstream end was opened so as to enable the water in the sand to drain better from the contact zone. This dam was 100 ft. high at its crest and almost 400 ft. thick at the base. The dam was made up of coarse material from a borrow pit. Through the center of the dam was put an impervious core of clay-like material that was 25 ft. thick and extended down into the bed rock. About half way up the face of the dike a storm drain tunnel was provided. When the sand got to that elevation, the tunnel was plugged off and storm drainage was through the tunnel further upstream.

When the sand fill was 100 ft. thick, or at the crest of this preliminary dam, the method of extending the height of the dam was by means of the sand in the pulp as herein described.

In spite of the precautions taken, the sand berm failed in a side canyon where it was built on a long gentle sloping ridge. Several hundred thousand tons of sand moved downhill several hundred feet, engulfing the pumping plant near the toe of the dam. This pumping plant returned the clear water from the tailing pond to the mill.

The breakage of the berm concentrated a great amount of study on its

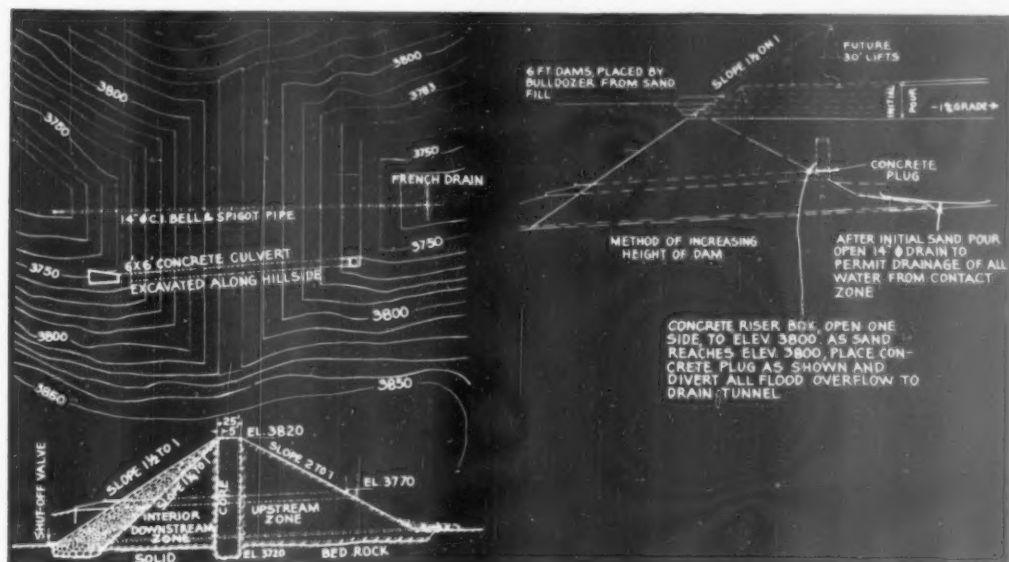


Fig. 3 Preliminary dam across a narrow part of the canyon

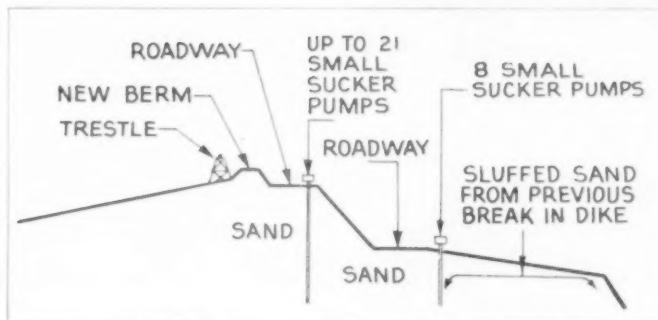


Fig. 4 Method by which small sucker pumps are used to stabilize the berm

cause, and on methods of preventing a recurrence. From that study the present technique was evolved.

Comparison with Public Projects

It is interesting to note that in many government dams where a compacted earth fill is used either as a wing dam, or as the main structure itself, the method of building such a compacted earth fill is almost exactly opposite to that used at Castle Dome. In other words the public projects, in some cases, use a compacted and impervious fill on both the upstream and the downstream zones, and the core is made up of porous gravel. The porous gravel has suitable artificial drainage in addition. Thus if there is any leakage through the upstream face, it drains out through the core and no hydrostatic pressure builds up against the downstream face.

If one studies Fig. 2 in the July issue, page 77, he will note that as the berm is built up by successive layers of sand from the pulp, and if the face of this sand is sloped, there is more and more tendency for the understructure of the berm to be weakened gradually, due mainly to inclusions of water in the area marked "sand-slime area." If this water could be drained or pumped out, it would obviously help to dry out that part of the dike and help to stabilize it.

Stabilizing the Dike

These operators decided to use many small pumps to accomplish this purpose. After a new dike was started above the broken dike, small pumps were installed. As the height of the berm increased, the set-up appeared as in Fig. 4. It will be noted that a roadway is provided at the outer edge of the uppermost berm. There are 29

of these small pumps in operation. They are Gould electric plunger pumps, rated at 2½ g.p.m. In setting these pumps, an 8-in. casing was driven to bedrock (from 25 to 190 ft.). Inside this casing was lowered a 6-in. pipe that was slotted at the lower end. These slots were ¼-in. (ten parallel rows) machined and the slots were spotted around the periphery of the pipe. Over these slots was wrapped nylon filter cloth held in place by bands. The details of this slotted pipe are shown in the accompanying line cut, Fig. 5. When the 6-in. inner pipe was in place, the outer 8-in. casing was pulled.

Operation of Stabilizing Pumps

The pumps operate automatically. In each hole electrodes are put 5 ft. apart so that when the hole has sufficient water in it to cause the top electrode to function, the pump starts. When the water has been lowered to the bottom electrode, the pump stops. All the water is collected from these small pumps and returned to be used in the mill.

It was thought that possibly if the number of slots in the pipe was doubled, the amount of water obtained would likewise be doubled, but on trials this did not prove true. This possibly indicates that drainage in the sand is from the entrained water in the sand immediately around the suction areas and not from a channel source. The pumps are arranged in two irregular rows across the lower face of the berm. Each pipe has from one to three sections of slotted pipe sections and each section is roughly 10 ft. long. Experience has shown that

water stays in the berm section a considerable length of time as indicated from production from each pump.

From the toe of the dike in the lower part of the canyon to the top of the present crest of the dam is a vertical distance of 225 ft. The face of the berm is kept at a slope of 1 to 1 1/2.

Trestle Construction

The trestle is kept back from the face a distance that depends on the height of the trestle at that point. If the height of the trestle is "H," then it is kept back from the face a distance of 1 1/2 "H" plus 15 ft. The trestle is made of 4 x 4's and the bents are about 10 ft. apart. The assembly is then well braced. The wet part of the pond has a slope of from 1 to 2 deg. from the horizontal.

The pulp in the pipe line on the trestle discharges through company-made molasses gates that are 10 x 12 in. These are banded to the redwood pipe and a steel handle for control of the gate extends upwards and on the side of the trestle that supports the walkway. (Owing to local conditions it was difficult to get a good photograph of these gates, so we are showing similar ones as used at the Miami Copper Co.'s tailing pond in Solitude Canyon. This will be described later.) The only apparent difference is that at Castle Dome the pipe line supports the added weight of the gate (it being carried in mind that cutting the wood pipe line weakens it) without further bracing. In the picture it will be noted that a wooden superstructure has been built over the molasses gate and is further supported by wire slings. The gates are spaced on 40-ft. centers. Under each gate is a movable, wide launder that can be spotted so as to deliver the pulp to the desired location.

Filling the Tailing Pond

In operation, enough of the gates in a given sector are opened so as to "spit" some pulp. The gate can be opened wide, if desired. The movable launder is usually pointed towards the outer edge of the pond or the berm. Enough gates are opened to take all the flow. The berm, at the site used, is usually 6 to 8 ft. high and has been thoroughly compacted by the "cat" and dozer so as to eliminate any pinholes in the berm. The attendant on the pond devotes most of his time to watching the areas being filled, for leakage through a pinhole can start a wash that would destroy the dam. After spitting pulp into the sector for several weeks, or until the new pulp has been built up about level with the berm, there will have accumulated under each gate a circular pile of the coarsest sands. If this pile is too far from the berm, the operator can open the gate wide for



In a smaller canyon near the Castle Dome mill, this emergency pond has been provided. Rock dike, left, consists of strippings. The sand dike is being built near its toe by an open launder with outlet spouts, with the feed coming from the far side. This parallels the practice at Bagdad.



This tailing pond broke some time ago and a part of the section that moved downhill is shown here. It is being built up gradually by an auxiliary pipe line. The main dike is at the extreme left where trestle can be seen.

a few minutes and the rush of pulp tends to flush some of the sand closer to the berm, and at the same time, this rush of pulp can be directed to the areas between the conical piles (which are high in slimes) and flush the finer material further away from the berm. Dropping a stream of pulp from heights such as at Castle Dome may be an important factor when compaction of the berm is considered.

The operators on such a tailing project are highly intelligent men and blessed with a fund of resourcefulness. They have developed a safe and skillful method of diverting the pulp to suit their particular needs, and as a result do practically no hand shoveling on the berms. Care and constant watchfulness are primary requisites, and they all seem to take great pride in the appearance of the berm and the face of the dike.

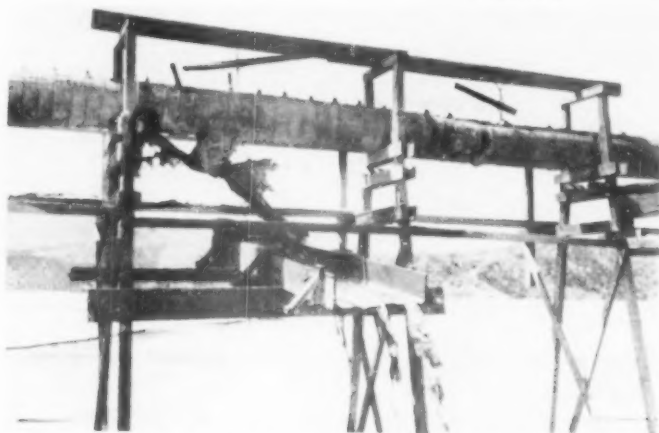
It will be noted that there are two

roadways across the dike. One is near the base or toe of the newer dike, and a still more recent one is almost at the same elevation as the berm.

Total area of the pond is 150 acres, of which about 12 acres contain clear water. One man per shift is kept on the tailing pond proper. A D-4 Caterpillar and dozer are used to build up the berm, and a dragline also is available for this work. Where equipment of this type is used on the berm, the design of the trestles, their spacing and location, must be such as to leave room for them to operate.

Drying the Tailings Area

The tailings area is sufficiently large that one section of it can be filled while a previously used section can dry out and consolidate. In two to four weeks of dry-out time a tractor and dozer can safely work on the berm. The top areas of the berm at



This picture was taken at the Miami Copper Co. tailing pond in Solitude Canyon. The gate shown here is the same type used at the Castle Dome operation.



One of the 2½-g.p.m. sucker pumps scattered below the berm of Castle Dome pond to recover water and help keep the berm consolidated and stabilized.

the time the tractor is in operation are dry and compacted, but if one digs down 15 ft. or more, he is apt to find mud. The trestle now in use has sufficient height to last 2½ more operating years. Several survey targets have been erected about the dike and back areas so as to gauge the height of the dam and water. A dirt road is maintained that practically circles the pond area. In this hilly area, it amounts to several miles of road bed.

Decant Line

To remove the clear water from the pond, a 14-in. steel decant line extends under the dike and the pond to the clear water area. This decant line rests on a firm bed-rock foundation and where possible skirts the edge of the pond area. To keep this pipe from ever floating in the thick pulp, concrete piers have been built

around it on about 25-ft. centers. These piers are approximately 2-ft. cubes. When it was suggested that concrete pipe be used for this purpose, it was thought that such a course would prove unsatisfactory—even disastrous. It was pointed out that the materials over this pipe would range from sand through slimes to water; that these could shift and throw strains on the pipe that could not be calculated easily. Hence for the decant line, steel should be used. If concrete pipe were used and if it should ever fail it could mean loss of the pond.

The decant line in use at Castle Dome extends to the extreme back of the pond where clear water has collected. It operates on the principle of a siphon. The outboard end of the decant line can be raised or lowered so as to skim nothing but clear water. The main leg of the decant line extends roughly at right angles to the berm and extends well above the clear

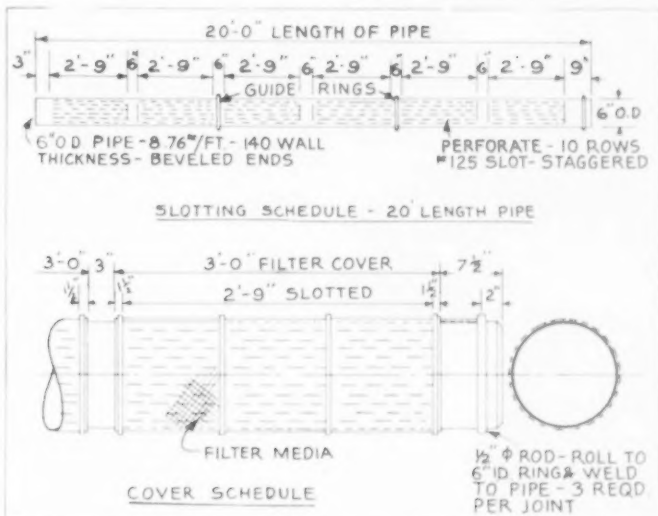


Fig. 5. Details of slotted pipe.

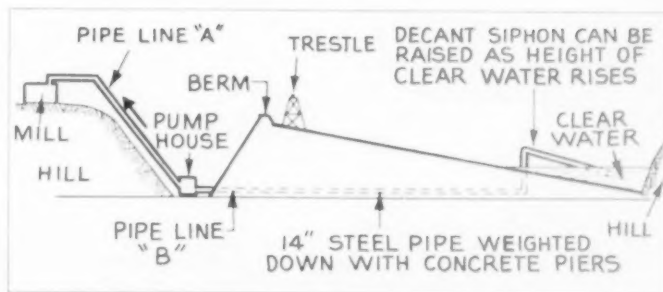


Fig. 6. If siphon stops working, the operator stops the pumps for a few minutes and the back pressure in pipe line "A," discharge side, fills pipe line "B" so that the siphon can function again.

water line. Its end there is welded shut. At right angles to this main decant line has been welded the temporary inlet that is practically horizontal. Its outboard end is supported by a temporary wood structure. On the outboard end of this horizontal pipe and at right angles to it is the section of pipe that dips its lower end into the clear water. An elbow at the junction of the two pipes allows the lower one to be raised or lowered as the berm grows higher (and the clear water horizon rises).

Pump House

By referring to Fig. 6 it will be seen that if the suction on the siphon line fails for any reason, the operator in the pump house below the berm can stop the pumps for a moment. This allows the water in the discharge leg of the pipe line to back up into the decant line, thus restoring the suction. A man is kept in the pump house below the berm on all three shifts. In this pump house there are four 2-stage pumps. One has a capacity of 900 g.p.m. and the other three are rated at 500 g.p.m. each. Each pump is powered by a 125-hp. U. S. Electrical Motors unit with a 6-in. discharge. The clear water is returned to the mill through a redwood, steel-banded pipe line that practically parallels the line carrying the pulp to the tailing pond.

Protection Against Floods

In the Globe-Miami area cloudbursts have been known to account for 2 in. of rainfall in 30 min., and 7 in. in two days. Hence some protection must be provided against these floods. At the Castle Dome operation the tailing pond is situated in a canyon and, for practical purposes, paralleling it is another canyon with the two drainage areas separated by a dividing ridge. At the upper end of the pond, and in the area where the clear water normally collects, a 1200-ft. tunnel has been driven to grade through the dividing ridge. The site for this tunnel was accurately surveyed and its elevations, with respect to the elevation of the berm, were taken into consideration. To the throat of this tunnel, a vertical riser section of concrete has been affixed with a circular interior section 7 ft. in diameter. This riser section is provided with large slot-like openings or doorways. These doorways or slots can be closed progressively by means of weirs. As the height of the clear water area rises, these slots are closed so that no clear water drains into the slots. By keeping the slots a few inches above the top of the lake, no clear water escapes into the tunnel. However, should a cloudburst occur, the sudden rise in the level of the pond would result in excess water draining into the tunnel, thereby preventing any overflows over the face of the berm. If the latter happened, the pond would be lost. The tunnel is 4 x 6 ft., inside measure-

ment, in cross section and timbered with skin-tight treated timber sets throughout its length.

In the canyon below the main dike some clear water collects. This is designed for seepage through the base structure as previously discussed and the water here is picked up by a Krogh pump which operates automatically. This water also is put back into service. No attempt is made here to control the dust that is an inherent part of a tailing dike, but it is interesting to note that fish have been planted in the lake or clear water section of the pond.

An emergency tailing pond also has been provided and in it are some 700,000 tons of tailings. Its essential points resemble the set-up at the Bagdad operation, previously described, in that a large dike was built across a

canyon using mine strippings. Then at the toe of this rock dam the tailing pond was started. The pulp to it is carried part way in pipe, but across the berm the pulp flows in an open launder with spouts at frequent intervals that unload at right angles to the launder. There are no elaborate trestles involved; the sloping face of the rock fill is used to support the launder. The water in the clear section is pumped out of the pond and put back into service by a semi-portable pump.

R. W. Hughes is general manager of Castle Dome Copper Co., Inc., and also of the Miami Copper Co. The offices are in Miami, Ariz. B. R. Coil is assistant general manager, and R. L. Mountjoy is concentrator superintendent. J. C. Van De Water is mine superintendent.

(To be continued)

Determination of Sulfate as SO_3 in Cement, Limestone and Gypsum

SMITH-NEW YORK, Freeport, N. Y., has developed a titration method of determining SO_3 for use on nonmetallic minerals. This method was found to show excellent agreement with the gravimetric method used formerly but allows earlier knowledge of the SO_3 analysis with less working time.

The method consists of titrating a solution containing sulfate ions with barium chloride, using the indicator, TETRA, (Smith-New York's preparation) which turns orange-red at the end point. The principle of the titration is that TETRA forms a red barium salt, but as long as there are sulfate ions present, barium sulfate is precipitated preferentially and no barium is available to form the red end point. After all the sulfate has been precipitated as barium sulfate, the next drop of barium chloride causes the red color to form, due to the precipitation of the barium salt of TETRA.

Since both the gravimetric and titration methods are based on the precipitation of barium sulfate, the accuracies of both methods are comparable. The limitations of the volumetric method in most cases are those of volume measurements; the gravimetric method requires standing overnight for accuracy.

There are several things to note in the preparation of the sample. It should be finely ground as required for A.S.T.M. testing. The sample is mixed with water and solid ammonium carbonate added. The mixture is then heated for 15 min. with occasional stirring, which extracts most of the sulfates present as ammonium sulfate but yet does not extract calcium which interferes with the titration when present. The calcium is converted to insoluble calcium carbonate by this treatment.

The mixture is then filtered and the filtrate evaporated by boiling until all the excess ammonia is evolved.

This is necessary since the titration will not be effective in the presence of excess ammonia. The evaporated solution is made up to 100 ml. in a volumetric flask.

For highly accurate work the material which was extracted with ammonium carbonate solution is then dissolved in a minimum of acid, made strongly alkaline with ammonium hydroxide, and solid ammonium carbonate added. The mixture is then heated till nearly boiling and is filtered. The filtrate is boiled until free of ammonia and is also made up to a standard volume.

In the titration of routine samples of materials such as portland cement, the SO_3 values are all within the same range, and the testing procedure serves the purpose of finding the exact sulfate content.

Three 10 ml. aliquots of the sulfate solution are taken. To each of these is added three different volumes of barium chloride solution representing the two extreme and one intermediate values of SO_3 contents expected. To each of the three flasks is then added 30 cc. of isopropyl or other alcohol, one drop of 1 percent sodium bicarbonate solution, and five drops of TETRA solution. The solution in the flask containing the largest amount of barium chloride solution should be red in color, thus indicating that it is beyond the end point. The flask with the least barium chloride solution should be yellow in color showing that it is not yet at the end point.

If the intermediate flask solution is yellow, it is titrated to the end point by adding BaCl_2 to the orange-red end point. If the intermediate flask solution is red, then the contents of the first flask (whose contents are yellow) are titrated to the end point.

Further aliquots can be taken and desired quantities of barium chloride solution added to check further or narrow the SO_3 value to desired extent.



Pontoon-mounted dredge pump, left, and power shovel loading truck with pit-run material, center, at southern sand and gravel operation



Rubber-tired, self-powered clamshell reclaiming stockpiled sand

Typical Hydraulic Plants in the South

Plants described are representative of Southern operators with relatively high capacities with low capital investment

MANY SMALL sand and gravel operations that have capacities from 150 cu. yd. per day and up are located in the South. Some of these operations are relatively new, but others have been in production for many years. These smaller operations are predominately pump operations, and use from 4-in. dia. to 6- and 8-in. dia. pumps, depending on the size of the operation.

Blackwell Sand Co.

A typical example of one of these smaller operations that has withstood the test of time is that of the Blackwell Sand Co. at Meridian, Miss. The plant produces a sharp, white sand that appears to be of glass-sand grade. The deposit of sand dips somewhat so that the upper portions are recovered by a Universal dragline, while material at lower elevations is recovered by a 4-in. Pecora pump directly connected to a small gasoline engine. The sand from the upper stratum is loaded to trucks and dumped to a point in the sump where the pump can easily pick it up and deliver it to a simple, home-made sand-settling box where two grades of sands are made from three outlets. A Unit clamshell rig loads the finished sand to a fleet of five trucks. Sand in the area sells for \$2 per cu. yd. for a three-mile haul. The company turns out about 150 cu. yd.

per day. Blackwell Sand Co. also is contemplating entering the concrete block manufacturing business.

Traxler Gravel Co.

A new plant in the same area is that of the Traxler Gravel Co., located at Crystal Springs, Miss., a short distance south of Jackson. The plant serves that area as well as the districts contiguous to the plant. One 6-in. pump driven by an International engine and one 8-in. pump driven by a Caterpillar engine, yield a capacity of about 2000 cu. yd. per day of washed sand and gravel. The pipe line from the dredge to the plant is connected with Hewett Rubber Co. sleeves. Black Bros. hose clamps are used on these sleeves.

The company also ships a considerable tonnage of pit-run clay-gravel material which is used for secondary road construction. There is about the right amount of clay in this mixture to make it bind well for road work.

The plant is of wood construction with stationary screens over two gravel pockets followed by a sand box in the launder to the waste pond. The pumps are mounted on pontoons, four to a pump, and use a "head" on the suction end.

The plant location is on the west side of Highway 51, 3 miles south of



Pontoons similar to this are used to support dredge equipment

Crystal Springs. Shipments are made over the rails of the Illinois Central Railroad and by truck. To ship by rail, the pit trucks must cross the highway and dump from a ramp into the gondolas. In the pit, a 20 ft. Bucyrus-Erie dragline and a Northwest shovel are used. There is said to be clay-gravel to a depth of 150 ft. at this site and strippings are in the 3-ft. range.

Southern Sand & Gravel Co.

A short distance north of Amite, La., the Southern Sand and Gravel Co. of Tangipahoa has built a new plant similar to those previously mentioned. Stationary screens are being used and material is pumped with an 8-in. and a 6-in. pump. The plant turns out 50 carloads of material per day from beds of gravel that are about 35 ft. deep, located on the I. C. railroad. Creed Richie, Amite, La., also operates two small pumps on the river near Amite. Near McCombs, Miss., A. W. Johnson and the Moffit Concrete Block Co. operate small dredge pumps.

Crushed Stone



The steps lead to the operator's platform of the breaker; two diesel engines in the center drive the impellers



Ready-mixed concrete plant of Binkley Bros., Inc.

Large Capacity With Single Crusher

Binkley Bros., Inc. at Lititz, Penn., producing crushed stone at the rate of more than 200 t.p.h. with double impeller breaker and single 3-deck screen

BINKLEY BROS., INC., has a crushed stone operation at Lititz, Penn., which is a short distance north of Lancaster. The quarry is not far from the extension work that is now going on in connection with the Pennsylvania Turnpike. Early in September of 1949 the company installed a New Holland 50-50 double impeller breaker. This

is the largest unit made by Iowa Manufacturing Co., and the designations indicate that the unit will receive rock up to 30 x 50 in. This installation is the third of this type that the Binkley Brothers have in service. First one to be installed is at the Millintown operation, where a 70-30 was installed as a secondary reduction unit. At a

new sand plant in the Lancaster area, Milton Grove Sand, Inc., an affiliated company, a 40-40 double impeller is used as the primary breaker and a roll mill for the final reduction (see the February, 1950, issue of *Rock Products*, p. 97). The installation at Lititz can be used to illustrate the simplicity of a plant built around such units, for the crusher is receiving quarry-run limestone and is reducing it to meet specifications in the 3 $\frac{1}{4}$ - to 7 $\frac{1}{2}$ -in. size range. The crusher is the only reduction unit in the entire plant.

Material Flow

The crushed product is elevated to a dry, 4 x 12-ft., 3-deck vibrating screen mounted over a steel truck-loading hopper. The oversize from the top deck of the screen returns to the impactor by a horizontal running belt conveyor. The plant is producing at the rate of 200 to 250 t.p.h. and it was indicated that the screen was overloaded at these tonnages. The 50-50 breaker is driven by two D-15000 Caterpillar diesels and each engine is belted with V-belts to one of the rotating impellers. A third Buda diesel engine drives an a-c generator and supplies power for the electric motors on the conveyors and on the vibrating screen. At the time of inspection the



Quarry loading is handled by a 1 $\frac{1}{2}$ -cu. yd. shovel



Six-in. pump and sand hose in quarry

breaker had crushed about 30,000 tons of stone without any repairs to the wearing parts of the unit. One man at the crusher operates the controls for the heavy-duty apron feeder, and except for labor required at the finished rock loading point, no additional labor is necessary. The crusher is a smooth running piece of equipment and judging from the material on all belts involved, it would appear that possibly 80 to 85 percent of the rock was reduced to the desired size at the first pass. In other words, the circulating load was small. Hardness of the rock can be judged from the drilling rate, for it was said that churn drills here could drill at the rate of 4 ft. per hr.

In this type of impact breaker, quarry stone entering the breaker chamber falls directly onto whirling impellers that rotate 450 r.p.m. or more. They rotate upwards and outwards. These two impellers throw the rock fragments upwards against breaker bars. The breaker bars are large diameter pieces of cylindrical steel that can be replaced easily and quickly. The wearing parts of the impellers are also reversible and replaceable. The throat of the machine has a mat of vertically hanging chains to prevent possible "thrust backs" from the impellers.

Quarry Operations

Quarry haulage is accomplished by four International trucks. A Lorain "75" 1½-cu. yd. and a 1¼-cu. yd. Lima shovel are used for the primary loading and two Keystone 50's for primary churn drilling. A small cabler-mounted Gardner-Denver compressor is used for secondary drilling. Water is removed from the quarry by a 6-in. Gardner-Denver pump which is connected to the intake and to the discharge pipe sections by lengths of Thermoid "300" sand hose. The company operates a fleet of ready-mixed concrete delivery trucks from this plant and recently installed a Fanning



In the foreground is the triple-deck dry screen over the loading hoppers; in the background can be seen the breaker



Large size rock is broken by the one crusher; returns from the triple-deck screen can be seen coming off belt at upper left

Schuett 3-bin, dry weigh batcher that is erected in a section of the quarry so that trucks can dump aggregates directly to the bins. A Hough rubber-mounted loader is used for reclaiming from ground stored material.

Company Officers

The offices of the company are at East Petersburg, Penn. H. M. Rinkley is president of the company and Ralph Rinkley superintendent of the Little operations.

Employee Facilities

SOUTHWESTERN PORTLAND CEMENT Co., Fairborn, Ohio, has built a park on company property to be used as picnic grounds and as a recreation center for its employees. The park, covering an area between five and six acres, has been named Powell Park in memory of Frank H. Powell, former president of the company who died in July, 1949. Employees and their families and company officials attended the recent dedication.

CONVEYOR BELT MAINTENANCE

USERS OF CONVEYOR BELTING will do well to heed the manufacturer's advice on the best means of procuring the maximum of usefulness. In medical circles preventive practices are considered better than expensive cures and the theory is applicable to plant equipment. Preventive maintenance is preferable to emergency repairs that tie up production and add distressing figures to the cost sheet.

Much depends, of course, on the primary installation and the correctness of the layout according to sound engineering principles if the maintenance staff is to be spared many a vexing headache in later years.

The layout should provide facilities whereby no heavy lumps or jagged edged material may fall on the belt from some distance to cut or bruise the surface. The ideal arrangement is to load material from chutes that slow the impact, or perhaps a V-notch can be arranged so that fine material may be deposited ahead of the course to provide a cushion which absorbs the shock of impact. Still another idea is the installation of a screen chute built from non-clogging wedge shaped bars between which fine material can be deposited ahead of the heavier and bigger lumps. Direct loading of material on the belt should be avoided by locating an idler from 4 to 6 in. behind the heel of the loading chute with another a short distance ahead which provides added support at the point of greatest impact and permits the belt to cushion the blow of the falling material. In no case should an idler be placed directly under the point of impact. Listed here are the salient features of devices recommended to improve belt performance.

- (1) Provide shock impact mountings to cushion the load by installing rubber-covered idlers or rubber disc rolls and rubber-mounted idler assemblies.
- (2) Install a pneumatic-tire type idler.
- (3) Provide a set of baffle bars so placed to break the impact of the load before it strikes the belt.
- (4) Install a notched chute so designed that the fines will be deposited ahead of the heavy stock and thereby form a cushion.

Regulation of the speed of the belt is important since the wear on the belt is primarily at the loading end; speeding up a belt to increase output does not increase the wear. In fact, abrasion is noticeably less with respect to the tonnage handled when the belt is fully and uniformly loaded and traveling at maximum speed.

By PAUL C. ZIEMKE

A large increase in tonnage life is thus achieved as against the under-loaded belt also traveling at top speed. To accomplish this, the installation of surge bins or mechanical feeding equipment is necessary.

Causes of Belt Wear

It is the author's opinion that in all probability the greatest belt wear is due to defective idlers. Many fail to turn at all or possibly turn so stiffly that much wear is caused and power wasted. This leads to worn spots and jagged edges that speedily become worse, greatly shortening belt life. The cause for these bad actors is easily found in the lack of lubrication or the presence of abrasive materials in the bearing. The remedy, of course, is some means of keeping out the grit and providing durable lasting lubricants that stay put and do not drip on the lower side of the belt to deteriorate the rubber. Next is the misalignment of idlers that cause crooked running belts and subsequent wear by forcing the belt to attempt climbing the misplaced idlers. In this connection it may be mentioned that the above condition is also traceable to the improper splicing of a belt. Any splice not made on accurately square cut ends will run crooked no matter over which part of the line it is running.

The average belt is spliced by metal fasteners, which if properly done and checked at regular intervals, can be a lasting job. But in all too many instances this type of splice is the most prolific cause of belt trouble. While the splice originally was a good one, perhaps no subsequent check-up has been made to determine the state of wear. For important conveyors field vulcanized joints are recommended to provide endless belts that are free from splice troubles for the life of the belt.

Take-Up Devices

Take-up devices are an important adjunct to the smooth operating belt since any undue slackness will almost double wear. Screw type take-ups installed at the tail pulleys in smaller plants will serve their purpose well, while in the larger installations and those where perhaps long centers are employed, the automatic or counter-weight type of take-up is best. These permit the belt to adjust itself readily to varying load and temperature

changes without much attention from the attendant.

Either type of take-up device, of course, is most effective on the return side and most often functions best after the drive. A regular inspection and oiling of these units will ensure their continued operation since all too often they are installed out of sight and for that reason are out of mind. In this connection it is well to mention the precaution of preventing material from falling onto the pulley side and permitting it to be carried over to the pulleys. This is most frequently found in plants handling lumpy or sticky material. The answer lies in the installation of good decking to cover the belt at points where spillage occurs, or perhaps a series of scrapers will keep the belt cleaned in a satisfactory manner. However, makeshift devices installed can easily accomplish more harm than benefit if the tension kept on them is too severe or the scraper's edge tends to wear the belt. A suggestion is to use strips of old belting fastened to scraper edges to provide a soft and almost non-wearing surface. The same strips serve very well to edge skirt boards that all too frequently start damaging wear on the belt's edges by causing it to fray and open up the fabric to moisture and dirt. Guide rollers improperly installed are also bad actors at times. Like skirt boards, they can speedily shorten the life of an expensive belt.

Idlers

In practically all instances where the conveyors are installed with the pulleys and idlers at true right angles to the center line, the load is in proper proportion to the size of the layout. Where these conditions are lacking, a recommended practice to overcome poor alignment is to install pivoted self-aligning side idler units that can help the situation considerably without adding either friction or wear. Rigid side idlers are recommended as a last resort.

While on the subject of idlers it is timely to mention the advisability of installing idlers according to properly engineered plans since improperly spaced idlers will not lend the required support to a loaded belt. The damage suffered by the belt as it sags unduly between idlers, only to be flexed and bumped as it rolls over each idler in turn, is quite marked.

Most conveyor installations include proper housing for the very essential part of the plant equipment. Where

such protection is lacking the wear on a belt is increased many times. Prolonged exposure to direct sunlight is most injurious to rubber. Most belts can withstand exposure to 150 deg. F. where ventilation is reasonably good and the direct rays of the sun are prevented from striking the rubber. Ordinary winter temperatures have no deleterious effect on belting, but it is strongly recommended that belts be free of moisture at such times since freezing temperatures during idle periods will start the disintegration of the fabric. Damp belts require careful attention to the proper tension maintained, and care must be exercised to prevent acids and other corrosives from attacking the fibers. Moisture aids the formation of mildew which, while it has no effect on rubber, can be very destructive to the fabric. Where belts must operate under continually moist conditions the purchase of specially treated belting should be given consideration. First costs are higher than standard lines but the added life well offsets any price differential.

In planning the belt conveyor layout it is of prime importance that pulleys of the correct size are installed. Undersize pulleys add greatly to the stresses inflicted on the belt by turning over the small radius. While no hard and fast rule can be applied, in general pulley diameters for single drives should be no smaller than five in. for each ply; for tandem drives six in. is proper. The drive that tends to give trouble by reason of lack of sufficient traction can often be improved greatly by the expedient of lagging the drive pulley with special 2- to 4-ply lagging material covered on one side with vulcanized rubber. Or, a good substitute can be fashioned from good portions of a discarded belt. The task of applying the lagging is not at all difficult since only sufficient holes are drilled to provide adequate grip for flat-headed bolts tightened up from inside the pulley. Periodic inspection is necessary to renew the lagging when the belt heads tend to project above the worn material and thus cause excessive belt wear.

In conclusion it must be mentioned that belt repairs must not be delayed. Small cuts and abrasions are usually quickly patched with plastic rubber compounds and self-vulcanizing cement. All loose and frayed material must be cut out or rasped away to provide a clean and sound surface on which to apply the compounds. Washing the affected areas with gasoline is recommended to remove all dirt and traces of grease or oil before application of the cement. Two coats of cement are required with time intervals allowed to permit drying before the plastic is applied and rolled smooth. For larger repairs, whole new sections of material may be required to make permanent repairs. Such larger jobs require the use of a vulcanizer to make durable and lasting patches.

Crushing Practice and Theory

(Continued from page 171)

sider any horizontal plane through this body of material as, for example, the plane at the receiving opening, represented by line "O" in the diagram. The crusher head is at the moment in the close-side position.

As the head recedes on its opening stroke, the body of material moves downward until, at the end of the stroke, the plane has moved to position "1." Note that the length of line "1," from concave to open-side head position, is the same as that of line "O," from concave to close-side head position.

On the next closing stroke line "1" is compressed by the amount of the head movement at that level, and on the next opening stroke it moves down to position "2" and so on down through the chamber, until it becomes short enough to pass through the open-side discharge setting.

We can just as readily visualize the process as being the movement of the trapezoidal areas enclosed by each adjacent pair of horizontal lines and the two crushing faces. Better still, we can consider it as the movement of annular volumes whose cross-sections are the areas just mentioned. This latter conception is essential in visualizing the action of non-choking concaves and flared crushing chambers.

In the diagram, the broken line through the center of the crushing chamber is the line-of-mean-diameters of the compacted areas. When the profiles of both crushing faces are straight lines, as in the case under consideration, this mean-diameter line is also straight, and its slope depends upon the relative tapers of the head and concaves. When the line approximately parallels the center-line of the crusher, which is also the case for the diagram we are examining, the theoretical action closely approximates that of the jaw crusher of similar cross-sectional proportions. Practically, however, the gyratory will have some advantage over the jaw, as regards freedom from choking, because the spider arms of the gyratory prevent a complete filling of the crushing chamber at the top. When the line slopes away from the crusher center-line at its lower end the characteristics change quite definitely in favor of the gyratory, as will be seen.

Preventing Chokes

It is apparent that although the distance between successive horizontal planes increases gradually as these planes move downward (due to increased throw of the head), the areas, and hence the volumes, successively decrease. If we conceive the volume 0-1 as consisting of a mixture of rock and air—that is, containing a certain percentage of voids—then it is evident that when this volume has moved to position 18-19, the percentage of these voids will be considerably diminished.

If it should happen that the voids have reached such a low proportion when the material drops from 17-18 to 18-19, that the closing stroke on 18-19 completely eliminates all voids, we have a choked condition at that point, a condition which is untenable because downward movement of the material ceases, and the crusher either stalls or fails at some point.

Clearly, there must be a maximum safe ratio between the volumes 0-1 and 18-19, a ratio which must depend upon the shape of the crushing chamber, the amount of head-movement, the percentage of voids in the feed, and upon the character of the feed, with particular reference to the manner in which it shatters in the crusher. The more fines there are in the feed, the less will be the percentage of voids, and the greater will be the chance of building up to a choked condition. This is especially true for high reduction ratios and close discharge settings; it is the reason why the careful crusher builder always cautions against feeding unscreened material to fine-reduction crushers. It is also understandable why it is advisable to use reduced throw eccentrics for settings below the manufacturer's recommended minimums. If a condition of near-choke should exist just above the discharge level, a large movement of the head may be sufficient to complete the choke; whereas a smaller throw would not be so likely to "follow through" to that extent.

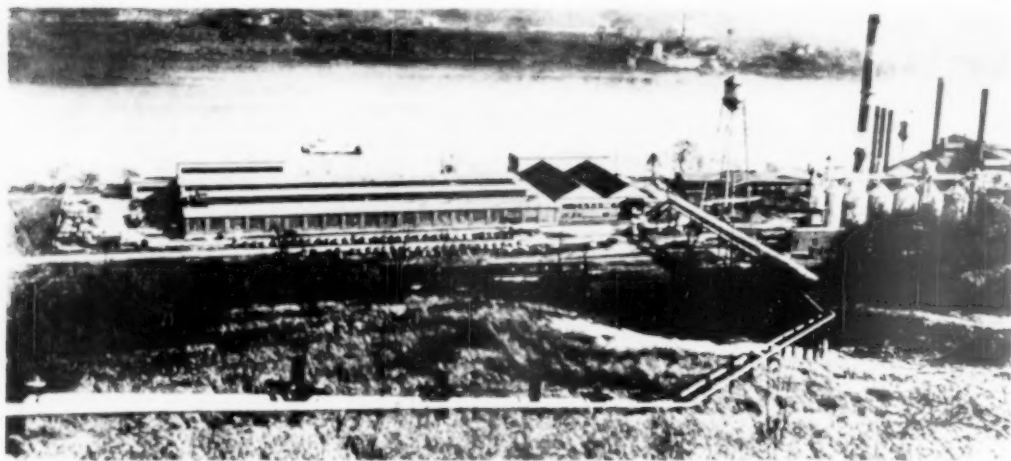
It is apparent that the choke-point in the crushing chamber we have been discussing is at the discharge level, or immediately above it. It is equally clear that the unit pressures in such a chamber increase progressively from the top, down, reaching their maximum value at the choke-point, where the voids are at a minimum. It follows that the amount of wear on head and concaves must increase progressively toward the lower part of the chamber. As a matter of fact, when the crusher setting and other conditions are such that the machine is operating at anything approaching a choke condition, wear is very rapid in the region of the discharge point, as compared to the rest of the chamber—so much so that "belling" of the head, and "dishing" of the concaves is likely to progress to a troublesome degree.

(To be continued)

Gravel Operation Refused

ARROWHEAD SAND AND GRAVEL CO., Duluth, Minn., has been denied permission to establish a gravel plant on a site in the city due to zoning regulations. Safety Commissioner Francis C. Daugherty declared, after the proposed plant had been turned down, that the city should help find suitable sites for small industries desiring to come into Duluth.

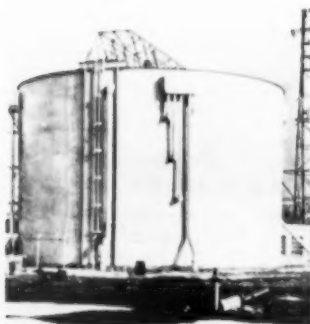
Disposal



Creighton plant of Pittsburgh Plate Glass Corp. with slurry pipeline, foreground, and Allegheny river in the background



Interior of main pump house



Solids settle to bottom of thickener and are pumped into basin. Clear water drains into the Allegheny river

Disposal of Abrasive Sludge

Thickener and settling basin installed to prevent pollution of Allegheny river from Pittsburgh Plate Glass Co. plant

By PAUL D. OESTERLE*

DISPOSAL OF SEVERAL HUNDRED TONS daily of a highly abrasive waste product that resulted from the grinding and polishing of plate glass confronted the Pittsburgh Plate Glass Co. in its program of cooperation to clean up Pennsylvania's streams.

Grinding and polishing plate glass at the Creighton, Penn. plant leaves several thousand g.p.m. of a water mixture of powdered glass, fine silica sand, emery, rouges, plaster of paris, and a small amount of powdered iron. To make a solution more abrasive than this probably would require diamond dust.

Former Practice

Until early last summer, this solution was allowed to flow from the plant into the Allegheny river, from which it was dredged periodically and loaded into barges for disposal. With emphasis on cleaning up Pennsylvania's streams, Pittsburgh Plate Glass Co. called in The Rust Engineering Co. to devise and build a disposal system for this waste that would not pollute the river.

Collaborating with Pittsburgh Plate engineers, a program was laid out, carried through, and put into operation on June 20, 1949. Now, only

crystal-clear water flows from the plant into the Allegheny, while the abrasive solids are pumped into a specially-built lagoon a mile from the plant.

Clarification of Water

A thickener was installed into which is pumped the abrasive water from the plant's industrial sewer. After passing through this unit, the water has a turbidity of less than 100 parts per million—almost crystal-clear water. This clear water flows into the Allegheny, while the underflow from the bottom of the thickener, a slurry with a concentration of one-third abrasive materials, is pumped through a mile-long pipe line, over a 320-ft. hill, and into a settling basin formed by damming a 700- x 1600-ft. natural hollow. The total clearwater head overcome on the system is equal to 320 ft. Here the solids settle out while the clear water eventually will overflow into a creek that empties into the Allegheny.

Rust Engineering's biggest problem in building this waste disposal system was in pumping 230 gallons per minute of the thick, abrasive sludge over

*Application Engineer, Dravo Corp., Pittsburgh, Penn.



Six pumps force waste from grinding and polishing departments through mile-long pipeline, left, to the top of a 320-ft. hill, and into the settling basin, right. Basin was made by damming a natural hollow

a hill to the basin a mile away. The powdered glass, fine silica sand, and plaster of paris would quickly wear out the metal plates, impellers, and other parts of ordinary pumps. Also important, this abrasive sludge would leak back through the clearance between the rotating impeller and the stationary side plate and into the stuffing box where it would quickly wear the shaft.

To solve both these problems, Dravo Corp., Pittsburgh, Penn., furnished six Allen-Sherman-Hoff Hydrosol rubber-lined slurry pumps, and assisted in the design and construction of the pumping part of the disposal system.

In Hydrosol pumps, all surfaces that come in contact with the solution being pumped are made of rubber, since it has been found that rubber outlasts equivalent metal parts four to six times.

Eliminating Pump Leakage

The other important advantage of the pumps was in eliminating the other problem—leakage of the abrasive slurry into the stuffing box. This is accomplished by introducing a very small quantity of clear, abrasive-free water into the clearances between the rotating impeller and the stationary side plate of the pump at a pressure slightly higher than the pump discharge. In this way it is impossible for the abrasive sludge to get to the stuffing box.

Pump Locations

Two of these pumps were installed in series at the thickener, and two each, also in series, in two booster stations along the line of four-inch extra-heavy steel pipe line. All pumps, V-belt drives, and motors are identical to permit the interchange of parts and to hold stocking of spare parts to a minimum.

Reversal of the flow of the sludge back through the pumps in case of a mechanical or electrical failure could cause serious damage to the system.

Anticipating this possibility, the design engineers installed a duplicate complete stand-by pumping system to take over automatically in case of failure. In the event of a complete

power failure so that the stand-by system could not operate, air-operated dumping valves were installed to discharge the sludge into a small emergency lagoon.

Gypsum Processing Described

BLUE DIAMOND CORP., Clark County, Nev., has its mining, milling and manufacturing methods described in a new publication by the Bureau of Mines. Although gypsum has been mined in Clark County since 1909, actual development work was not started by the company until 1925 following a two-year investigation of the deposit. The company gradually expanded both its industrial plant and the variety of its products.

The circular describes both the open-pit and underground mining systems currently employed on the company's deposits on the tops of the foothills of the Spring Mountain Ranges. The circular also deals with geology of the area, exploration, loading and transportation methods, equipment, crushing plant, plaster mill, board and boiler plant, company organization and wage rates. A flow sheet including engineering drawings and photographs of equipment is given.

Free copies of Information Circular 7555, "Mining, Milling, and Manufacturing Methods at the Blue Diamond Corp. Gypsum Property, Clark County, Nev." may be obtained by writing to the Publications Distribution Section of the Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Penn.

Ballistics Research Report

A BALLISTICS RESEARCH REPORT, originally issued by the Army Ordnance Department in 1948 as a restricted document, has been reprinted by the

Bureau of Mines and is now available to the public as Ballistics Research Report No. 675, "Investigation of the Propagation of Blast Waves Over Relatively Large Distances and Damaging Possibilities of Such Propagation."

In the report an attempt is made to derive those meteorological conditions which are conducive to blast wave propagation and to establish "rules of thumb" which will enable a person, with the aid of temperature and wind soundings of the lower atmosphere, to determine the presence of dangerous or disturbing propagating conditions. Several appendixes concerned with derivation of the formulae for the propagation of sound in the atmosphere also are included. The report may be obtained free from the Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Penn.

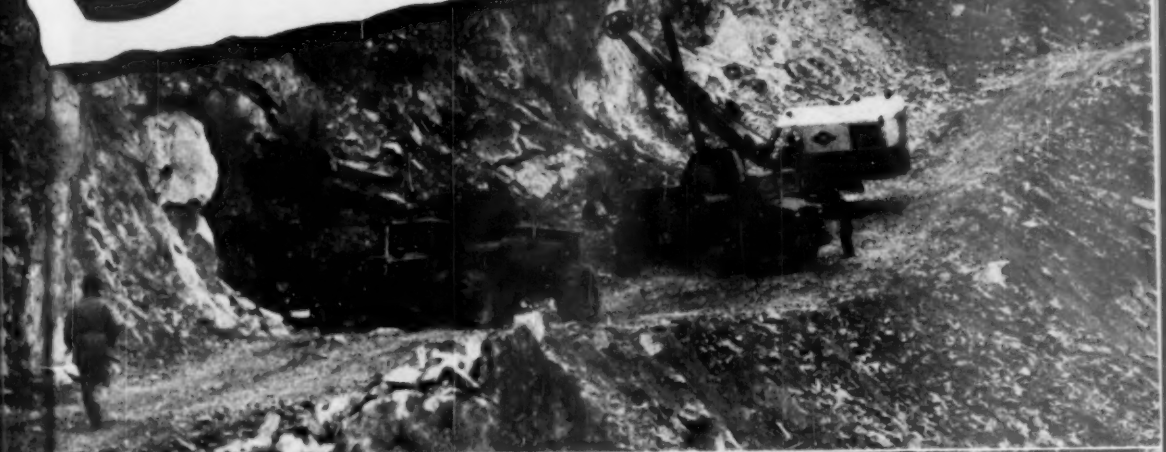
Vermont Talc Maps

THE U. S. GEOLOGICAL SURVEY has released three maps of Vermont talc deposits. These maps show the results of studies made in 1945 by Marland P. Billings of Harvard University and Alfred H. Chidester of the Geological Survey. The talc deposits studied are the Mad River mine near Fayston, the Rousseau prospect near Cambridge, and the Carleton quarry near Chester.

Copies of these maps, released as Strategic Minerals Investigations, Preliminary Maps 3-227, may be obtained free of charge by writing to the Director, U. S. Geological Survey, Washington 25, D. C.

3 TOURNAROCKERS

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Pine Canyon project"*



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GOODFELLOW Brothers, Inc.,

tackled one of the northwest's toughest highway jobs . . . relocating 4.4 miles of U. S. 2 along steep sidewalls of rocky Pine Canyon, near Wenatchee, Washington. With over 600,000 yards of shovel rock to be carved out of the cliff face, some of the material is side-cast . . . much of it has to be hauled and dumped along the mountainside trail to widen narrow sections. Goodfellow Brothers, Inc., assigned the most difficult hauling to 3 LeTourneau 16-ton, rear-dump Tournarockers . . . and according to James B. Goodfellow "They are working out very satisfactorily".

Here are contractor's own figures

Loading under a 2-yard rock shovel, the Tournarockers carry 9 to 11 bank yards each trip. On one 2800-foot, one-way haul, actual job records show that Tournarockers easily handle shovel production of 1000 yds. every 8-hour shift. This rate of production, day in, day out, helps keep the job on schedule in spite of the rough haul roads, steep grades, and confined hauling conditions at altitudes of 2000 feet.

13' 9" turn radius speeds handling

Short, 90° turns, and positive electric steer by push-button control, permit easy turning and spotting anywhere along the narrow trail for load and dump position. Oversize, disc-type air brakes on all 4 wheels (4176 sq. in. total braking surface) give operators complete safety throughout the hauling cycle. Positive holding action of 4-wheel brakes . . . plus front-wheel drive on 186 h.p. Tournapull prime mover . . . let the Tournarockers dump safely out over the edge of mountainside fills. Simple electric hoist raises body to vertical position . . . streamlined bowl clears loads instantly.

Important savings for you

These same revolutionary Tournarocker advantages that are helping Goodfellow Brothers, Inc., lick steep slopes and rough going on the Pine Canyon project offer new low-hauling costs for your jobs, too. Ask your LeTourneau Distributor about this 16-ton, rear-dump Tournarocker. He can also give you complete information on 9-ton and 35-ton Tournarockers . . . and will show you money-saving interchangeability with Carryall Scrapers, bottom-dump hoppers, cranes, flat-beds and other auxiliary hauled units. Your investment dollar provides steady year-round earnings with interchangeable auxiliary units at approximately 25% of the cost of the original unit. Write or call NOW!



Big target . . . Operator on Goodfellow Brothers' 2-yard shovel has large target with Tournarocker's 12' 5" x 8' top opening . . . speeds shovel swings, has less spillage.



Rock body . . . Here's a typical load of big-chunk rock carried by Tournarockers along Pine Canyon's slopes. 186 h.p. for 16-ton capacity licks the toughest hauling conditions.



90° turns with positive power steer . . . Short 13' 9" turning radius is an important advantage where operators have to turn and dump their loads along these narrow trails.



Front-wheel drive . . . Means you can keep the drivewheels of the prime mover on firm ground. Front or rear wheel air brakes can be set independently.

LETOURNEAU
PEORIA, ILLINOIS

TOURNAROCKERS

TRACTION ADVANTAGES of A CRAWLER PLUS HIGH-SPEED on RUBBER

Burning Cement

(Continued from page 113)

the bulk of the fuel is gasified and possibly cracked, producing a hot mixture of combustion gases and combustible gases. Secondary air for complete combustion is introduced from the bottom of the kiln. Thus two gas streams are flowing in opposite directions to each other to produce a hot zone, the position, depth and temperature of which may easily be regulated by the corresponding adjustment of valves. By having opposing gas streams, turbulence is greatly increased, so that the "dead" gas film along the material surface is affected by greatly irregular transverse movements. This gas film is rubbed away more effectively than by gas streams which would flow in one direction, thus enabling maximum possible heat transfer rates.

Gilbert's method was used to calculate the amounts of heat transferred in each stage. A closely controlled large scale production test served as a basis for the measurements; however, the calculated figure was much lower than that computed from actual measurements, being 248,000 B.t.u. per minute against 246,000 B.t.u. per minute. (Calculation details are given on page 115).

By this new method of fuel and air introduction into a vertical shaft kiln, and with the primary and secondary air and gas streams flowing in opposite directions to each other, not only can the highest heat transfer be achieved, but it is possible to attain close control of the hot zone as well. The nodules can be sintered to a greater degree by increasing the amount of primary air, or to a lesser degree by the addition of some fuel gas. Thus the gas flow and hot zone can be kept uniformly spread over the whole cross sectional area of the kiln. The uniformity in spreading the hot zone of nearly even temperature across the entire cross sectional area from one source of fuel inlet only is assured due to the dependency of resistance to gas flow upon the degree of clinkering. Thus, those sections of the material which would contain insufficiently burned clinker would have less resistance to gas flow in these sections, and would inevitably draw more fuel to those places, thus re-establishing uniform clinkering. Through use of a double contact manometer in the primary air chute, which regulates the speed of clinker discharge according to resistance to gas flow, completely automatic operation of the kiln with uniform quality of clinker can be assured.

During the war, in the Middle East, where a large percentage of the cement needed for military purposes was produced in mixed-feed vertical kilns working on British anthracite, it was necessary to adapt oil firing in these kilns because it was impossible to transport coal through the Mediterranean. The first oil-fired kiln was put

in operation in 1944. There were difficulties in achieving completely satisfactory operation with this first oil-fired Middle East kiln. However, through introduction of many novel arrangements, a successful plan of operation was perfected and thus more kilns of the same principle and design were installed. These kilns represented a basis from which further improvements could be attempted.

Low B.t.u. Consumption

In 1946, a representative of Swiss Cement Manufacturers visited these plants and studied the kilns in operation for some time. Based on this study, it was decided to install a similar kiln in one of the most modern cement plants in Switzerland, where there already was a Lepol kiln in operation with low labor utilization and a fuel consumption of approximately 640,000 B.t.u./bbl. of clinker. But, unfortunately, during the time of the erection of the kiln and due to the war

psychosis, the price of oil increased greatly, necessitating that the kiln start operations on coal. Although performance was excellent on coal, as proved by the fact that operation of a third kiln is already contemplated in competition with Lepol kiln performance, it would be a great contribution to the progress of the vertical kiln if a reasonable oil price would permit its operation on oil or gas, not only from the point of view of fuel, but also for permitting application of the central chute, visible and controllable flame and opposing primary and secondary air and gas streams for the promotion of heat transfer. Great prospects for the vertical kiln will be opened up when it can be "directly fired" from the center, i.e., operating an easily observable gaseous flame, similar to rotary kiln practice, but at a much improved heat transfer rate. Benefits would include saving on kiln length, built-in area and equipment costs in general.

Ball Loading in Tube Mills

(Continued from page 109)

stalled and changed annually. Very little wear was experienced at other points.

Originally the Krump firm intended to make an installation at the back wall, providing it with slits. However, this would require each compartment to be filled separately with grinding media. Because of varying wear on the grinding bodies, the weights in the different compartments would have become unequal, requiring special additions from time to time. This condition would produce pounding in the mill and an increase in power requirement. For this reason, a space of about 80 cm. is required between the front and back wall for the Concentra installation. At the front wall as shown in the illustration, a dam of about 1.20 diameter should be provided and divided in two parts. This permits convenient access to the compartments for repair. It also would result in maintaining equalization of the charges in the several compartments, with elimination of variations in power and in pounding during running. The amount of grinding media in this intermediate space is not great. The shortness of the second compartment naturally reduces the power requirements. Therefore, the dam in the second compartment should be as large as possible, but the proper diameter must be worked out experimentally.

It is desirable, in making the installation in a raw mill, to provide for removal of a great quantity of dust, in order to achieve a rapid progression of the feed and to draw out all of the dust. The better the dust removal, the better the yield.

Since the clinker was passing too rapidly through the mill, it was necessary to install sheets to close part of the exit slits in order to secure the desired fineness. In the raw mill, any

moisture remaining should be swept out by the use of hot gases, produced by burning fine coke in a suitable burner. A minimum draft of 40 mm. is required for dust removal.

Of greatest importance is the choice of length of the single compartments. The size and hardness of the feed determines these dimensions. Before rebuilding any mill, preliminary experiments should be made to permit determination of the proper compartment length. It is desirable to call in an engineer thoroughly acquainted with the Concentra installation.

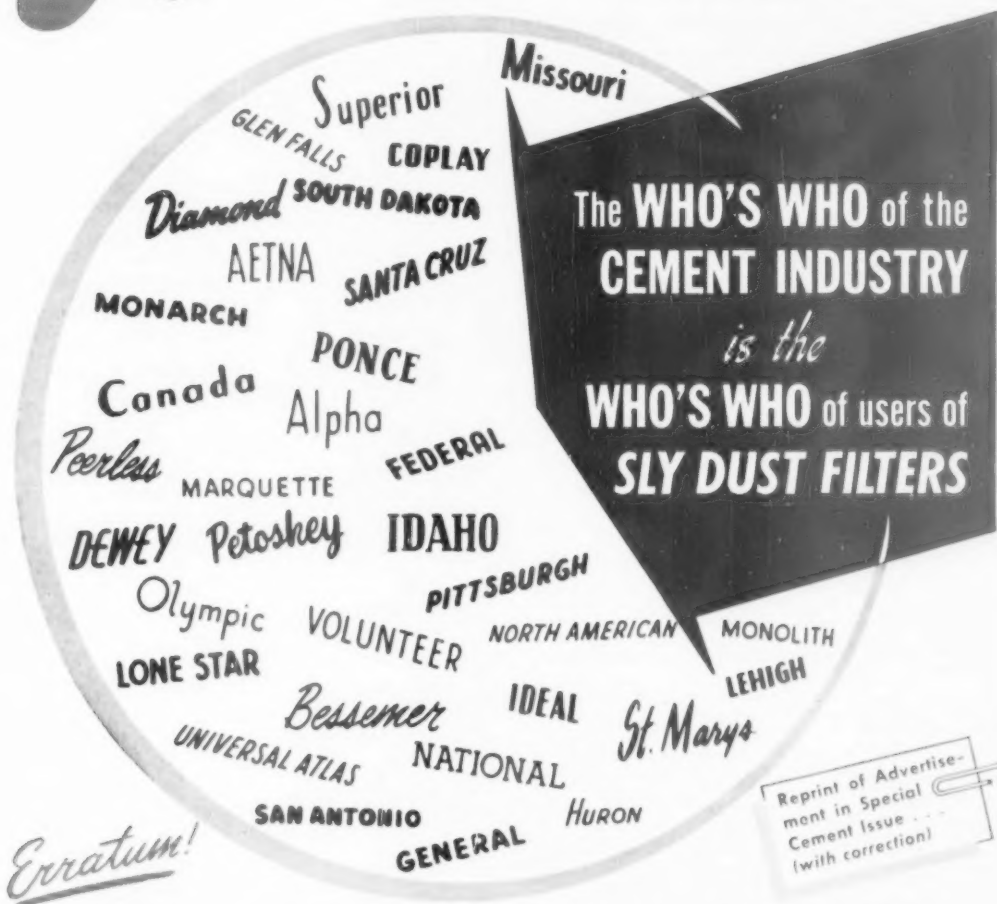
Feed Screening

It is not only desirable but probably necessary to screen the feed as it leaves the first compartment. The reason is that the small grinding media in the second compartment cannot handle efficiently very much oversize without serious reduction in production. In order to fit a given tube mill with the installation, the effects of the increased weights must be checked to determine whether the shell and bearings are adequate to carry the load. If they are not, it should be determined whether they are capable of enlargement. Manholes must be installed for the second and third compartments. Further preliminary work is not to be anticipated.

In conclusion, it might be stated that the installation of Concentra sheets results in appreciable reduction in power, especially where a second compartment is built into the mill. In this way the capacity is increased, the power required is reduced, and a very good fineness with improvement in quality of product is obtained. When an old mill is to be rebuilt, an evaluation of the mill should be made to determine its suitability for this purpose.

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"There is a Baughman Distributor Near You"

Lightweight Aggregates

(Continued from page 108)

grate. The sinter protects the cast iron grate from excessive heat during the sintering process. Discharged cakes of sinter, after being cooled, are crushed and sized.

Machines are constructed in various sizes from 50 ft. to more than 100 ft. in length and from 5 to 12 ft. wide. Usually of heavy construction, they require considerable power to move the grate as well as to maintain a proper vacuum at the windbox. A 500-hp. fan motor is usually needed for the smaller units. The machines are high in initial cost, ranging from \$250,000 for a complete plant using the smaller machine at 30 cu. yd. per hr. aggregate production, to well over \$1,000,000 for high-capacity sintering machines for nodulizing iron ore.

A flow sheet for a typical sintering plant is shown in Fig. 12.

Batch Sintering Machine. A versatile sintering machine, and one that may be favored by the small producer, is the Mace batch hearth for capacities from 5 tons per 24 hr. to 300 tons per 24 hr. A producer may enlarge his plant capacity by increasing the number of units which are operated by the same loading, firing and unloading devices.

Raw material is prepared in a manner similar to that employed in the continuous machine and charged to each grate by a loading car. Ignition, sintering and discharging of each grate is controlled to give the proper sinter cake.

The costs of the sintering machines alone are shown in Table II for various capacities.

Acknowledgment is expressed to the Portland Cement Association, under whose sponsorship most of this data was obtained.

Bibliography

- R. C. Specht and W. E. Herron, Jr., "Lightweight Aggregate from Phosphate Slimes," *Rock Products*, May, 1950, p. 96.
- John E. Conley and John A. Ruppert, "Lightweight Aggregates," *Mining Engineering*, April, 1950, p. 479.
- Office of the Housing Expediter, "Lightweight Aggregates for Concrete & Survey," 1947.
- Housing and Home Finance Agency, Washington, D. C., "Lightweight Aggregate Concretes," Table 3, p. 8.

Wage-Hour Provisions Coverage Bulletin

THE ADMINISTRATOR of the Wage-Hour law has issued an Interpretative Bulletin—Part 776 on "General Coverage" of the Wage-Hour Provisions of the Fair Labor Standards Act, as amended in 1949. The bulletin, according to its introductory statement, is "a practical guide to employers and employees as to how the office representing the public interest in its enforcement will seek to apply it." The bulletin is divided into three major parts, which are the bases for application, entitled "How Coverage is Determined," "Engaging in Commerce," and "Engaging in The Production of Goods for Commerce."

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Bucket design, accurate finger-tip control and powerful tractor "crowd", combine to cut bucket-fill time for the HT4 TRAXCAVATOR. Then as speedily as the HT4 can pivot turn, the fast-acting constant power hydraulic system raises the bucket to dumping height desired.

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And this hydraulic companion of world-famous cable-controlled TRAXCAVATORS is engineered to match the full capacity of its "Caterpillar" Diesel tractor teammate. The HT4's exclusive girder-type frame and heavily reinforced bucket of 3/8" steel permits it to excavate tough clay or load shot-rock, in stride!

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INFORMATION

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1 BUCKET LOADERS—N. P. Nelson Iron Works, Inc. has published an 8-page bulletin, Form 501, describing and illustrating Models P-11 and Q-11 heavy-duty bucket loaders, on wheels or crawler-mounted, for handling loose material up to 3-in. cube, maximum weight of 150 lb. per cu. ft., from stockpiles or bank run sand and gravel pits. Rated loading capacity is 3 to 4 cu. yd. per min. Specifications, construction features, and illustrations of typical applications are also shown.

2 BUCKETS—The Wellman Engineering Co. has issued Bulletin No. 144, describing and illustrating clamshell and dragline buckets for industrial uses and for general excavating and material handling purposes, hoists, gas producers, valves, etc. Typical applications are also shown.

3 CONCRETE VIBRATORS—Syntro Co. has brought out an 8-page bulletin describing and illustrating Models V-55 and V-75 concrete form vibrators with vise clamp, flexible shaft mass concrete vibrators, and Models VF-24, VF-30 and V-12 vibrating floats for concrete and mastic floors. Typical applications are shown.

4 CONNECTORS—Joy Mfg. Co. has published an 8-page bulletin, No. MC-108-2, describing and illustrating molded Neoprene rubber electrical connectors and associate equipment such as lamp sockets, distribution centers and vulcanizers. Constructional features, styles and applications are included.

5 CONTROL DRIVES—Bailey Meter Co. has published a 16-page brochure, General Specification CA-942, presenting control connecting linkage for use with its control drives. Construction features, diagrams, typical arrangements, and engineering and price data are also given.

6 CONTROLLERS—Wheelco Instruments Co. has released Bulletin PO-1, describing and illustrating the Potentiometer, a potentiometer controller, operating with the "Electronic Link," for controlling temperature, speed, flow, pressure, static strain loads, ac and/or dc volts, amperes, etc., of any type of industrial equipment.

7 CONTROLS—Wheelco Instruments Co. has issued Bulletin CAB-1 describing and illustrating a line of instruments known as the "Cabinet Series," designed to enable the user to incorporate auxiliary equipment into the case of a direct reading electronic controller, and are used for measurement, indication and automatic control of temperature, speed, flow, pressure, volts, amperes, etc. Suggestions for combining auxiliary control devices, specifications and prices are also shown.

8 CONVEYORS—Robins Conveyors Div., Hewitt-Robins, Inc. Bulletin No. 135 describes and illustrates the Vibra-Veyor[®] which is said to produce balanced mechanical operation without counterweights and to produce from lengths up to 200 ft. actuated by a single vibrator. Construction features, sizes and applications, and other information is contained in the bulletin.

9 CRANES—Tractor & Equipment Co. has announced Catalog No. 150, describing and illustrating the Jones Model KL-15 one-ton wagon crane, designed and manufactured in England and equipped with American motors and other component parts manufactured and installed in U. S. Specifications, recommended working loads, and typical installations are also given.

10 CRUSHING ROLLS—Traylor Engr. and Mfg. Co. has published a 40-page bulletin, No. 5637, describing and illustrating three different types of crushing rolls. Specifications, sizes, construction details, setting

drawings and dimensions, parts list drawings, and charts for determining the capacity of crushing rolls, also directions for using charge, are also given.

11 CYLINDERS—Ledeon Mfg. Co. has released Bulletin CS-849, describing and illustrating the application of hydraulic cylinders in a concrete block machine. Details and operation of the cylinders are discussed.

12 DERRICKS—American Hoist & Derrick Co. has released a 36-page catalog, No. 200-D-3, describing and illustrating six different types of steel derricks, including stiffleg, guy, steel erector, barge and special derricks, in 2½- to 250-ton capacities. Specifications, large photographs showing typical applications, diagrams, construction details, and diagram showing range of operation are included.

13 DRILLS—LeRoi Co. has released Bulletin T-16, describing and illustrating the 105 Tractair Mobildrill. It shows the combination tractor-compressor and light wagon drill in action and gives complete specifications and dimension data. A separate case history tells the story of "One Day's Drilling Completed in Just Two Hours," a sequence of operations in drilling a pattern for agricultural limestone quarry. The number of this bulletin is M-6.

14 DRIVES—Link-Belt Co. has published an 80-page Book No. 2324, describing and illustrating three types of worm gear drives, each available in ten different sizes, for fractional or large horsepower, and in speed ratios of 3½ to 1 up to 6000 to 1. Typical drive problems and solutions, construction features, etc., are given.

15 DUST CONTROL—Whiting Corp. has announced Bulletin FY-107, describing and illustrating several types of Hydro-Clones for suppressing dust and sparks from cupolas, shake-outs, sand-handling systems, grinders, mixers, etc., by thorough wetting of dust particles to a sludge. Typical installations are also shown.

16 ELECTRODES—Alloy Rods Co. has published Bulletin No. 10350, describing and illustrating various types of Wear-Arc hard-facing alloy electrodes. Properties, welding procedure, typical applications and sizes are also given.

17 ELECTRODES—American Manganese Steel Division has released Bulletin 650-W, describing and illustrating rods, electrodes and other welding products for hard-facing and repair of equipment. Composition, properties and typical applications are given.

18 FEEDERS—Robins Conveyors Div., Hewitt-Robins, Inc. has issued Bulletin No. 134, describing and illustrating the Vibra-Feeder[®], a fully mechanical vibrating feeder, available in a range of sizes from 24 in. to 48 in. wide and 48 in. to 96 in. long. It is claimed that only a 2-amp. draw is required from the ½-hp. motor.

19 FURNACES—Laclede-Christy Co. has issued a 6-page circular, Bulletin 128A, describing and illustrating its complete line of refractory products such as cements and mortars, silica brick, acid proof brick, insulating fire brick, plastics, castables, coatings, etc. A 5-point maintenance service is also given.

20 IDLERS—The Conveyor Co. has issued two folders on troughing idlers and return idlers, featuring the new "snug" design and its application to permanently lubricated ball-bearing type idlers and roller bearing idlers.

21 LIFT TRUCKS—Lyon-Raymond Corp. has issued Bulletin 241, describing and illustrating the 1000-lb. capacity hydraulic high lift truck. Specifications and construction details, also line drawings, are given.

22 LUBRICANTS—D-A Lubricant Co., Inc. has released a circular on D-A diesel oil, describing how and why it reduces engine deposits and neutralizes destructive combustion chamber acids. It also discusses problems encountered with fuels having a high-sulfur content.

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23 LUBRICATION—The Farval Corp. has released an 8-page bulletin entitled "Studies in Centralized Lubrication" giving examples of savings through installation of its centralized system of lubrication for feeders, crushers, conveyors, shakers, screens, elevators, washers, jigs, dryers, miners, loading booms, etc.

24 MOTORS—U. S. Electrical Motors, Inc. has published a 4-page bulletin, Form F-1801, describing and illustrating Type VA, U. S. Variable drive motors in fractional horsepower with a speed range of 4 to 10,000 r.p.m. Specifications, cutaway drawing, and seven modifications of the design are shown.

25 PUMPS—The Dorr Co. has published a 4-page bulletin, No. 5002, describing and illustrating the Type W diaphragm pump which is said to handle up to 75 cu. ft. of pulp per minute. Construction features, and cross-sectional diagram are also shown.

26 PUMPS—Leiman Bros., Inc. has published a 16-page Catalog 450, describing and illustrating 2-wing and 4-wing rotary positive type air pumps, designed for producing vacuums up to 29 in. and pressures up to 25 p.s.i. Construction details, specifications, dimension charts and performance curves are included together with a section on air motors.

27 PUMPS—McNally Pittsburg Mfg. Corp. has published a 34-page maintenance catalog No. 550, describing and illustrating heavy duty centrifugal slurry pumps and valves, conveyor chain and conveyors, elevators, screens, transmissions, conveyor and drive pulleys, V-belt sheaves, etc. Dimension drawings, specifications, and data tables are also shown.

28 RECORDING GAUGES—The Bristol Co. has published a 32-page bulletin, G-621, describing and illustrating recording gauges in ranges from 0 to 2 in. of water to 0 to 10,000 p.s.i. vacuum ranges, low range draft and pressure gauges, barometers, and absolute pressure gauges for ranges as low as 0 to 6 millimeters of mercury absolute. Measuring elements, operating principles, recording charts and accessories are included.

29 ROPE—New Bedford Cordage Co. has designed and produced a rope reference wall chart giving specifications on manila, nylon and steel ropes. Such data as rope diameter, circumference, approximate net weight of 100 ft., approximate gross weight full coils, breaking strength and working strength is included for sizes ranging from 3/16 in. to 3 1/2 in. in diameter.

30 RUBBER HOSE—Hewitt Rubber Division, Hewitt-Robins, Inc. has announced a 6-page bulletin, No. 137, describing Servall rubber hose for air, water, gasoline, oil, mild chemical or low pressure spray requirements. Construction and design features are also given. Another bulletin, No. 129, explains the design, construction and rubber compounds of Conserve air hose.

31 RUBBER PIPE—The Hewitt Rubber Div., Hewitt-Robins, Inc. has issued an 8-page bulletin, No. H-1, explaining the applications and comparative qualities of flexible rubber pipe as against metal pipe in many services. Case histories and recommended applications are also given.

32 SEPARATORS—Dings Magnetic Separator Co. has released an 8-page catalog, No. C-1109-A, describing and illustrating Types PA, FA and SA Perma-Drum magnetic separators for processing abrasives, foundry sand, stone, and many other materials. Construction details, capacities, dimensions, and diagrams of the three types are also included.

33 SHEAVES—Allis-Chalmers Mfg. Co. has published a 12-page bulletin, No. 20-B-7223-A, describing and illustrating the Vari-Pitch automatic sheaves in speeds ranging from 1 1/2 to 40 hp. Selection tables, dimensions, construction features, etc., are included.

34 SHOVELS—The Eimco Corp. has released a 4-page bulletin, No. 1021, describing and illustrating the 104 RockerShovel for bulldozing sand, gravel, rock or other bulk materials. Shovel is said to load at rate of 8 to 10 cu. yd. per min., and is available with diesel engine or electric motor.

power. Specifications, typical installations, and dimensional drawings are included.

35 SLUDGE TANKS—Whiting Corp. has issued a 2-page bulletin FY-106, describing and illustrating Type CV Hydro-Clone sludge dewatering tanks, the ejector type for automatic unloading and the twin type for manual unloading. Dimensions and cutaway views are also given.

36 SMOKE INDICATOR—Combustion Control Corp. has issued Bulletin CM-506, describing and illustrating the Fireeye smoke indicator for indicating the density of smoke passing through the stack of a power plant and signalling when the smoke exceeds a predetermined value. The indicator consists of a light source, a photoelectric scanner, and a control and indicator. Specifications, voltage regulation, and maintenance requirements are also given.

37 SPEED REDUCERS—De Laval Steam Turbine Co. has published a 32-page bulletin G-WBV, describing and illustrating various types of IMO-DeLaval worm gear speed reducers. It describes how the worm gears are manufactured, lists types of speed reducers, selection tables, horsepower ratings, overhung load rating tables, and dimension tables.

38 SPOUTS—Richardson Scale Co. has released a data sheet, No. 5001, containing complete specifications for a new dust-tight swivel spout, designed to eliminate routing of hatches by dusty swivels or conveyor plows, and available with either manual or automatic controls. Large three-plan diagram is included, with all dimensions clearly marked.

39 STEEL PRODUCTS—Manganese Steel Forge Co. has issued an 8-page bulletin describing and illustrating Rol-Man rolled and forged manganese steel plates, bars, rounds, squares, flats, bolts, pins, shafts, bushings, liners, wear plates, etc. Rol-Man flat-lock woven manganese steel screens are also shown.

40 TRACTORS—Caterpillar Tractor Co. 12-page bulletin, Form 12987, entitled "Producing Pit Profits with 'Caterpillar' Equipment," describes and illustrates use of tractors, bulldozers, scrapers, etc., in mining, quarrying, and gravel pit operations. Typical installations are shown.

41 TRAILERS—Martin Machine Co., has released a 4-page bulletin describing and illustrating the "Folding Goose-neck" trailer in capacities of 20, 27 and 32 tons, for one-man operation in loading or unloading equipment such as heavy tractors, motor graders and shovels. Also pictured is the lower platform height for greater clearance for viaducts, bridges and wires.

42 TRUCKS—Clark Equipment Co. in its Volume 8, No. 1, issue of Material Handling News, entitled "How To Handle It," describes and illustrates many applications of fork-lift trucks and attachments. It features the new Bartel device, a crate clamp which eliminates use of pallets, the new Clarkette-5 truck, the new Universal clamp and its adaptations, also a map showing location of U. S. dealers.

43 VIBRATORS—Mall Tool Co. has released a 4-page bulletin, Form 2022, describing and illustrating various types of concrete vibrators, including the electric one-man vibrator, the 2- and 4-hp. gasoline engine vibrators, the 1 1/2-hp. Universal motor vibrator, the 2-hp. two-man Universal vibrator, the 3-hp. geared head electric vibrator, the pneumatic vibrator, etc.

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January 21, 1930

Erie Steel Construction Co.,
Erie, Pennsylvania

Gentlemen:

Belvidere Redi-Mix Co. of Belvidere, Boone County, Ill., is owned by Transwell Construction Co. of Rockford, Ill. Our plant started operations in the middle of May of 1929 and we are continuing to pour concrete daily even during cold weather.

Belvidere, Ill., is a city of about 10,000 population and is the center of a very prosperous farm territory. Because of the fact that belidized concrete was completely new to the majority of the contractors in our city, it has taken some time and effort to educate them to its many advantages. However, such much from May through December showed an increase in total output, and we have yet to have our first dissatisfied customer. We have poured concrete for state highways, public schools, bridges, commercial and residential construction, and all types of farm work. We have covered a radius of 10 miles from our plant with little or no difficulty.

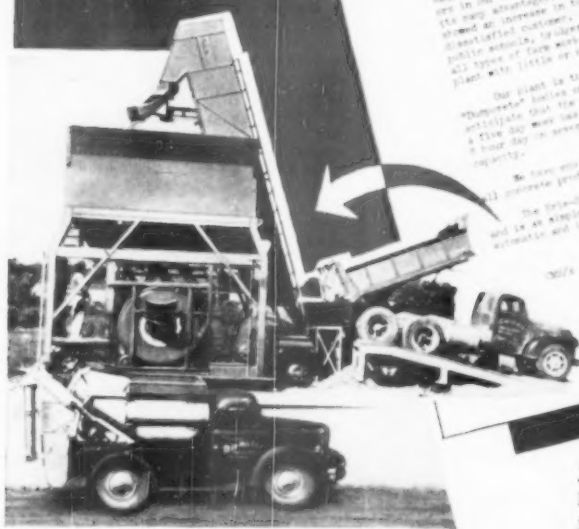
Our plant is the "Powers" belidized mix type, and we are using "Dumpsters" loaded in our trucks. We have at present 3 trucks, and anticipate that the next summer will keep all of them going steadily on a five day week basis. During the past summer we had 10 yards in an hour day in several locations and we were not applying to fill requests.

We have equipped our plant with steam heat, and during winter all concrete produced is heated and the water is used in heating. The belidized plant has proved very adequate for our needs and is as simple in operation as any we have seen. It is completely automatic and is powered by electricity.

Very truly yours,

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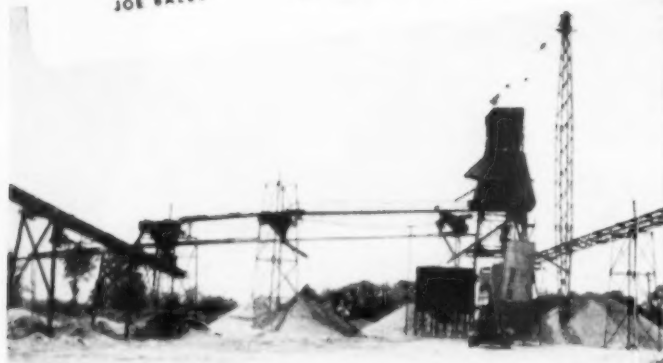
SCORES of ERIE-STRAVER Portable Concrete Plants all over the U. S. A. are moving from job to job making specification concrete. Many are equipped with Auxiliary Concrete Bucket Hoist, which lifts a batch to forms, conveyors, truck mixers, etc. while the next batch is mixing. Reach out for business—make up to 40 cu. yds. of concrete per hour on the job site. Write for catalog SP-2.





JOE BALES

**300 Yards a Day
for 3½ Years...
"I couldn't want
a better screen."**



IKE many widely experienced men in the aggregates business, Joe Bales has used a number of different screens, but the one he is using now at the Bluff Road Sand and Gravel Company, Indianapolis, Indiana, is a Deister Vibrating Screen.

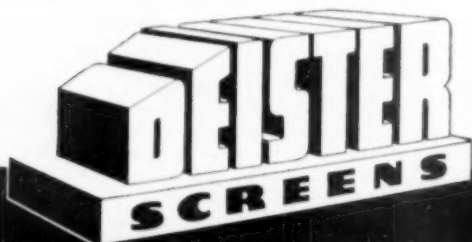
"In 3½ years of operation, we've never had any trouble with this Deister screen," says Mr. Bales.

"And the screen sure handles the load. To produce 300 yards a day, we often must get 1 yard a minute from this screen. I can say that it is really built... and really good. In fact, I couldn't want a better screen."

The Deister employed at Bluff Road is a triple-deck 3'x8' unit,

sizing 1½" 1. gravel, ¾" gravel, and ¼" concrete sand. This unit, like all Deister Vibrating Screens, has an exclusive, elliptical throw with vigorous, positive action for fast accurate sizing. It is ruggedly built, with simple, oil bath lubricated two-bearing construction for long, trouble-free service.

It is the kind of screen that operators like Joe Bales say will "put more profit in your business." Why not get all the facts on Deister Vibrating Screens for your operation? Just ask for a copy of Bulletin No. 50 which shows you how to specify the proper vibrating screen for your requirements.



DEISTER MACHINE CO.
FORT WAYNE 4, INDIANA

Labor Relations Trends

(Continued from page 73)

defined as "the state or quality of being older than another in point of service as recorded on the company payroll as an employee, and all workers retained in the employ of company 30 days shall be considered regular employees (construction excepted), and placed on the seniority list from the date of employment.

"(B) In the case of reducing the force, plant-wide seniority shall prevail—departmental seniority to be given first consideration in the case of promotion.

"(F) Should it be impossible during periods of scarcity of work for the Employer to furnish employment for all those additional employees placed during the busy periods, the force of employees may be reduced. In this reduction, however, seniority shall govern the selection of those to be laid off, the older employees in the length of service to be retained. This does not apply to employees who are not considered regular employees and attained seniority rights in accordance with this agreement."

The company argued: (1) That these were temporary, not permanent or regular employees. They had accepted work with this qualification printed on their application blanks: "It is my understanding that this job is temporary for the duration of the [war] emergency." (2) The layoffs were temporary and not a reduction in working force, hence Article 5 (B) quoted did not apply. (3) The contract did not permit "bumping" [replacing employees with less seniority]. (4) The company was not discriminating because of sex, for the three women themselves had refused or failed to make application for 25 or 30 job openings which had been posted before the layoff. (5) The company had given these women the only work it had available which they were capable of performing.

The board of arbitration decided that since the women made no applications for other jobs as they opened up, that while they were "regular employees" within the meaning of the contract, they were not entitled to "bump" junior employees except in their own classification—Miscellaneous Labor. The report states: "It is conceivable that there may have been junior employees retained in this classification doing work of which these employees were capable during the time they were laid off. But, if such there were, the Union has failed to name them or prove that fact. In the absence of such proof, the arbitration board has no choice but to deny the Union's request [for these employees to exercise their seniority, and be paid for time off], and find no satisfactory evidence has been produced to establish that these employees were laid off in violation of the contract."

We think this case merely emphasizes the necessity for a meeting of

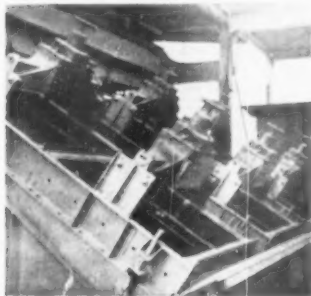
minds in the writing of seniority provisions. The fact that the three employees were women apparently had no bearing on the case. They were doing the only kind of work they were fitted for both in the company's point of view, and as demonstrated by their own lack of interest in any other kind of a job they could have applied for. Therefore, they determined their own classification, and it would have been the same were they male instead of female.

Aggregate Plant

(Continued from page 103)

or be by-passed back to the primary crushing plant or to the final screening section. This set-up, while extremely simple in execution, affords a selection of crushed rock sizes ahead of the final screening plant. The over-size from the secondary screening section can be juggled so as to give a wide variety of sizes. The sizes demanded by the trade are conveyed direct to the finishing screens. The sizes not in immediate demand are returned to the cone crushers to be crushed or finished to the desirable sizes.

The general plan of operation in the secondary screening section is to take out the minus $\frac{3}{4}$ -in. material and send it to its battery of dry Hum-mer screens mounted over the bins in



Three of the screens in final screening section

the final screening section. These Hum-mer screens are fed by individual Jeffrey electric vibrating feeders; they make a neat and efficient installation. The top size of stone taken off this same secondary screening section ranges from 3 in. to 11½ in. with the sizes under 1 in. predominating. The plus $\frac{3}{4}$ -in. material then goes up its inclined belt to two F-600 Tyrock dry vibrating screens for a final sizing, and the minus $\frac{3}{4}$ -in. goes up its belt to the bank of Hum-mer screens. The minus $\frac{3}{4}$ -in. portion previously mentioned is split finally into two sizes by the Hum-mers: a plus $\frac{3}{4}$ -in. minus $\frac{3}{4}$ -in., and a minus $\frac{3}{4}$ -in. or rock dust. The gravel and sand from the ball screen are elevated to the top of the plant and screened as formerly.

A considerable portion of the plant's output is shipped by truck and a new set of platform scales with a 60-ft. deck has been installed to expedite the weighing of long trucks and trailers.



HOW TO GET RID OF WATER ... 1950 STYLE

When it comes to getting rid of water in mining operations, you can depend on Naylor light-weight pipe to do the job.

It's easier to handle and install Naylor Pipe. You can string lines over any kind of terrain and know that they will stand up to the service.

Naylor's exclusive Lockseam Spiralweld structure makes this dependable performance possible. It gives you pipe that is extra strong and safe... far tougher than ordinary light-weight pipe.

Sizes range from 4" to 30" in diameter with all types of fittings, connections and fabrications.

Look into the performance advantages of Naylor for your water lines, air lines and other requirements.

Write for Catalog No. 44.



NAYLOR PIPE COMPANY

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**EAVESDROPPER
EXTRAORDINARY**

The Hardinge "Electric Ear" is the only device of its kind that maintains maximum grinding mill capacity by "listening" to the sound of the mill load.

It compensates — electronically — for changes in grindability due to variations in size of feed, density of feed, etc., producing a more uniform product, increasing mill capacity and freeing the operator for other duties. Write for Bulletin 42-7.

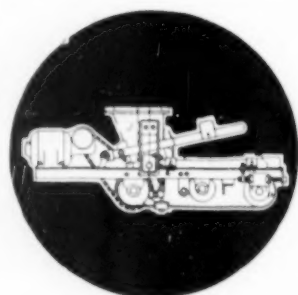
*Registered U. S. Patent Office.

... and don't
forget ...



"Keeps my ball
mill up to snuff"

HARDINGE Constant-Weight Feeders



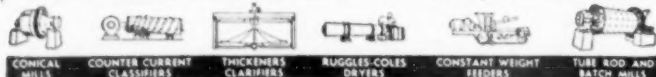
The revolutionary Hardinge Constant-Weight Feeder regulates the feeding of materials at a constant-weight rate, rather than a constant-volume rate. The feeder automatically compensates for changes in specific gravity and bulking, due to moisture — which normally would cause irregular feeding. An excellent grinding partner for the "Electric Ear" feed control unit.

Write for Bulletin 33-D-7.

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Financial

RECENT DIVIDENDS

Alpha Portland Cement Co.	\$.40	Sept. 9
Canada Cement pfd. pf.	Q. 32½	Sept. 20
Canada Crushed Stone Ltd.	.20	Sept. 20
Gypsum, Lime & Alabastine	.35	Sept. 1
Gypsum, Lime & Alabastine	.35	Dec. 1
Hercules Cement Corp.	Q. .50	Oct. 1
Lehigh Portland Cement Co.	Q. .50	Sept. 1
Penn. Glass Sand Corp.	Q. .45	Oct. 1
Penn. Glass Sand pfd.	Q. 1.25	Oct. 1
Riverside Cement	\$5 pf. Q. 1.25	Aug. 1
Riverside Cement cl. A.	ac. .50	Aug. 1

PEERLESS CEMENT CORP., Detroit, Mich., reports a net profit of \$429,354 for the first six months of 1950, compared with \$329,101 for the same period in 1949, or \$1.42 a share on 310,062 shares of common stock for 1950, as against \$1.06 a share in 1949.

CELOTEX CORP., Chicago, Ill., listed a net profit of \$250,689 for the three months ended January 31, 1950, or \$.20 per common share on 905,472 shares, and \$.98 pfd. share on 256,863 shares. This compares with a net profit of \$455,631 in the same period of 1949, or \$.43 per common share and \$1.77 pfd. share. Net sales for this same period in 1950 were \$9,409,786, as against \$9,638,791 in 1949.

KENTUCKY STONE CO., Louisville, Ky., has reported a net income of \$205,868 for the year ended April 30, 1950, as compared with \$227,416 net income for the preceding year. Earnings per common share for the period ending in 1950 were \$6.55 on 28,800 shares, and earnings for pfd. shares were \$29.80 on 6908 shares. For the 1949 period, earnings per common share were \$7.27 on 28,800 shares, and for pfd. shares, \$31.59 on 7200 shares. Net sales for the same period were \$1,641,201 in 1950, as against \$1,478,036 in 1949.

CONSOLIDATED CEMENT CORP., Chicago, Ill., has reported a net profit of \$173,000 for the first six months of 1950, or \$1.73 per cl. A share, on 99,916 shares. This compares with a net profit of \$135,800 for the corresponding period of 1949, or \$1.36 per cl. A share. The net sales for the first six months in 1950 totaled \$1,985,200, as against \$1,721,700 for the same period in 1949.

MARQUETTE CEMENT MFG. CO., Chicago, Ill., has reported its account of income for years ended June 30 as follows:

	1950	1949
Net sales	\$19,007,244	\$17,777,688
Other revenue	1,284,042	1,459,337
Total	20,291,286	19,237,025
Cost of sales	13,207,897	12,665,152
Selling, etc., exp.	2,310,189	2,424,620
Other expenses	294,925	364,423
Net earnings	4,478,275	3,792,830
Interest	128,902	138,514
Income taxes	1,674,512	1,430,914
Net profit	2,674,861	2,223,402
Earn., pfd. share	\$46.79	\$33.46
Earn., com. share	7.74	6.33
No. of pfd. shares	65,582	68,062
No. of com. shares	320,000	320,000

NEW ENGLAND LIME CO., Adams, Mass., lists a net profit for the first quarter of 1950 as \$23,492, compared with \$14,479 for the same period in 1949. Net sales for the first quarter of 1950 were \$390,877, as against \$331,157 for the first quarter of 1949.

LONE STAR CEMENT CORP., New York, N. Y., for the six months period ended June 30, has given the below statement of income:

	1950	1949
Sales	\$38,541,766	\$29,142,274
Cost of sales	17,675,948	16,894,750
Selling, etc., exp.	2,441,884	2,054,519
Deprec. and deplet.	1,098,209	1,010,847
Operating profit	9,342,745	8,222,162
Other income	936,082	229,582
Total income	9,678,777	8,951,740
Misc. charges	538,702	528,817
Fed. income tax	2,477,979	2,278,901
Other income tax	500,944	490,184
Other taxes	1,294,449	1,164,897
Pen. exch. res.	215,000	425,000
Net profit	4,742,015	4,222,877

*Includes provisions for doubtful account and contingencies.

Note: Results of South American subsidiaries included above are figured at average exchange rates (subject to foreign exchange and depletion) which is based on dollar value of fixed assets at time of acquisition. Cuban results are figured at par of one Cuban peso equals one U. S. dollar.

BOSTON SAND & GRAVEL CO., Cambridge, Mass., reported a net profit, for 1949, of \$57,322, or \$15 per common share on 49,135 shares, and \$4.03 pfd. share on 14,221 shares, compared with a net profit of \$93,582 for 1948, or \$82 per common share on 49,135 shares, and \$6.15 pfd. share on 14,221 shares. Net sales for 1949 amounted to \$3,237,743, as against \$2,822,235 in 1948.

The company also reports that management has recommended to directors that stated value of common stock be reduced from \$20 to \$1 per share. There are 49,135 common shares outstanding. Reduction would increase capital surplus by \$933,565. Against capital surplus created management proposes to charge off: goodwill, \$337,500; excess cost of Seitate property, \$198,527; and deficit of earnings as at Dec. 31, 1949, \$205,082.

GIANT PORTLAND CEMENT CO., Philadelphia, Penn., lists a net income of \$706,378, or \$82 per share on 862,874 shares for the year ended June 30, 1950. This compares with a net of \$461,766 for 1949, or \$54 per share on 850,319 shares for the like period of last year. Net sales for the 1950 period were \$5,107,585, as against \$3,593,403 for the 1949 period.

GENERAL PORTLAND CEMENT CO., Chicago, Ill., has reported the below account of income for the six months ended June 30:

	1950	1949
Net sales	\$11,930,100	\$10,265,400
Cost and expense	6,711,200	6,274,400
Operating profit	5,118,900	4,111,000
Other income net	12,103	200
Total income	5,130,900	4,110,800
Fed. income tax	1,950,700	1,563,900
Net profit:		
March quarter	1,530,900	1,140,900
June quarter	1,600,200	1,403,900
6 months	\$ 3,130,200	\$ 2,544,800
Earn., com. share:		
March quarter	\$1.47	\$1.19
June quarter	1.59	1.39
6 months	\$3.06	\$2.58

No. of com. shares 3,039,971 1,019,234
*Based on 1,016,705 shares.

ARUNDEL CORP., Baltimore, Md., reported a net profit of \$114,549 for the first quarter of 1950, as against a net profit of \$108,348 for the corresponding period of 1949, or \$2.26 per common share on 438,376 shares in the 1950 period, and \$2.25 per common share in 1949.

HAISS Material Handling BUCKET LOADERS



FOUR MODELS

Load 3 to 8 Yards per min.
SELF-PROPELLED
SELF-FEEDING

For loading: sand, gravel, stone, top-soil, coal, snow and similar materials. One man operation. wheel or crawler mounted. Equipped with swivel chute or with swivel belt conveyor. Special new features include: Sealed anti-friction bearings on head and tail shafts, two or four wheel drive, hydraulic raising and lowering, manganese or roller chain.

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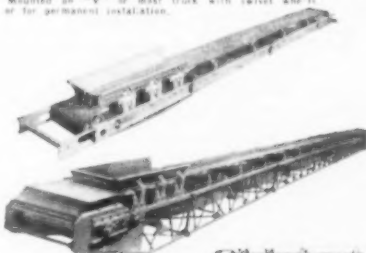
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For handling all types of loose or packaged materials. Mounted on "V" or motor truck with swivel wheel or for permanent installation.



UNDERCAR UNLOADERS

Designed and built especially for loading sand, gravel, and crushed stone. Combines high belt and positive chain drive. Capacity up to 5 tons per minute. Ask for bulletin No. 301.



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Channel or Lattice Frame construction. Made in easily assembled standard sections for permanent or portable installation. All sizes and capacities available for handling all types of aggregates as well as bagged or packaged materials.



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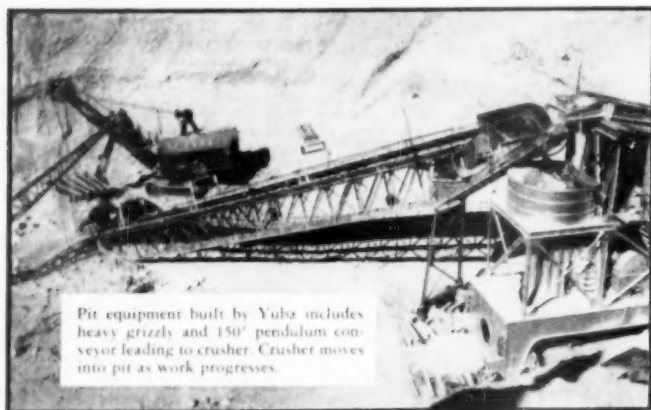
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DREDGE EXPERIENCE PAYS OFF

YUBA BUILDS PLANT TO PROCESS 17,000 TONS ORE DAILY

Steep bedrock, porous ground, and pit depth of 375' made the use of bucket ladder dredges impractical on Round Mountain Gold Dredging Corporation's vast ore bodies in Nye County, Nevada. To profitably work the property, a new approach was required.



Pit equipment built by Yuba includes heavy grizzly and 150' pendulum conveyor leading to crusher. Crusher moves into pit as work progresses.

COMBINATION METHOD SOLVES PROBLEM

Yuba engineers, in cooperation with Mr. W. C. Browning, Vice-president and consulting engineer of the Corporation, designed a plant that is basically a combination of gravel and open pit mining methods coupled with a dredge-type treating plant. A shovel and rail mounted crusher with pendulum conveyor handle the ore in the open pit. Belt conveyors carry the ore from pit to stockpile. At the stockpile, YUBA erected a complete dredge-type treatment plant, with revolving screens, jigs, gold tables, sand pumps, sand wheels, and tailing stacker. This YUBA-built plant is capable of moving 17,000 tons of ore from pit, through mill, to tailings every 24 hours.

YUBA WILL BUILD TO YOUR ORDER

You, too, can profit from YUBA's more than 40 years of experience in designing and manufacturing dredges and allied equipment for digging and treating alluvial materials. Bring your problems to specialists — YUBA MANUFACTURING CO. No obligation; just write or wire TODAY.



Plant combines dredges and hard bedrock processing methods.



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PENNSYLVANIA-DIXIE CEMENT CORP., New York, N. Y., had the following income account for the second quarters of 1949 and 1950:

	1960	1949
Net sales	\$ 6,259,899	\$ 4,827,720
Cost and expenses	4,338,287	3,435,474
Deprec. & deplet.	200,352	181,391
Operating profit	1,721,260	1,192,860
Other income, net	125,495	81,912
Total income	1,847,203	1,224,779
Funded debt int.	15,339	19,199
Fed. income tax	691,000	460,000
Net profit	1,140,864	745,680
Earn., com. share	\$1.89	\$1.24
No. of com. shares	602,136	602,136

ALBERENE STONE CORP. OF VIRGINIA, Schuylar, Va., has reported a net profit of \$44,394 for the six months ended June 30, 1950, as against \$16,848 for the same period in 1949, or \$67 per common share on 65,745 shares, as against \$2.26 for 1949. Net sales for the first six months of 1950 amounted to \$836,097, compared with \$660,517 for the corresponding period in 1949.

CALAVAS CEMENT CO., San Francisco, Calif., has called its remaining 841 shares of 7 percent preferred stock for redemption Oct. 1, 1950, at \$110 a share plus \$1.75 accrued dividend. On July 20, the company announced a dividend of \$3.50 a share on this stock, payable July 31. Retirement of the 7 percent preferred will leave the company with only its \$5 par value common stock and a funded debt of about \$1,000,000 in 4½ percent cumulative income sinking fund debentures outstanding, its 5 percent prior preference stock having been retired last March 31.

NATIONAL GYPSUM CO., Buffalo, N. Y., has published the following account of income for the six months ended June 30:

	1950	1949
Net sales	\$33,965,314	\$27,936,411
Cost of sales	22,700,974	20,474,288
Selling, etc. exp.	5,811,930	5,248,155
Operating profit	7,452,410	6,213,968
Other income	79,752	70,254
Total income	7,772,162	6,284,222
Interest	211,217	230,340
Doubt. accts.	92,583	76,995
Income taxes	2,154,580	635,425
Income taxes	2,794,000	1,561,400
Net profit	4,459,484	3,144,062
Earn. pfd. share	144,500	\$27,137
No. of pfd. shares	100,000	85,000
Operating margin operating: 3 mos., 1950, 13.1%; 1949, 11.0%; 6 mos., 1950, 15.1%; 1949, 17.0%.		

†After depreciation, depletion and amortization: 3 mos.: 1950, \$604,474; 1949, \$629,041; 6 mos.: 1950, \$1,161,792; 1949, 1,189,647.

LAWRENCE PORTLAND CEMENT CO., New York, N. Y., listed a net profit of \$874,586 for the 12 month period ended June 30, 1950, as against \$832,692 for the preceding year. This represents \$3.89 earned per share on 225,000 shares in 1950, and \$3.70 in the 1949 period. Net sales for the same period in 1950 were \$8,153,675, compared with \$7,384,701 in 1949.

NAZARETH CEMENT Co., Nazareth, Penn., reports a net profit of \$478,735 for the year ended March 31, 1950, compared with a net profit of \$534,760 for the twelve months ending March 31, 1949. This represents \$2.75 per common share and \$67.89 pfd. share for 1950, as against \$3.11 per common share and \$67.76 pfd. share for 1949.

ALPHA PORTLAND CEMENT CO., Easton, Penn., reported the following income statement for years ended June 30:

	1950	1949
Net sales	\$20,281,650	\$21,076,878
Oper. expenses	12,541,879	12,388,489
Maint. and repairs	2,626,671	2,539,696
Deprec. and deplet.	674,788	680,781
Operating profit	4,936,302	5,458,902
Other income net	147,450	477
Total income	5,083,752	5,459,379
Fed. income tax	1,955,200	2,116,563
Net profit	3,128,552	3,342,816
*Prev. surplus	6,557,331	4,608,097
Common divs.	1,517,084	1,399,578
*Surplus, June 30	8,168,799	6,557,331
*Includes \$995,446 capital surplus.		

PENNSYLVANIA GLASS SAND CORP., Lewistown, Penn., reported a net profit of \$294,804 for the first quarter of 1950, as against \$232,381 for the same period in 1949, of \$.80 per common share and \$.51 pfd. share in 1950, and \$.60 per common share and \$.70 pfd. share in 1949.

PERMANENTE CEMENT CO., Oakland, Calif., for the first quarter in 1950 reports a net profit of \$960,295, or \$.68 per share on 1,400,000 shares. This compares with a net profit of \$599,700 for the same period in 1949, or \$.86 per share on 700,000 shares.

The KELLEY ISLAND LIME & TRANSPORT CO., Cleveland, Ohio, lists net profits for the first six months of 1950 as \$369,834, or \$1.20 per share of 308,952 shares, compared with \$363,743, or \$1.18 per share in the same period of 1949. Net sales amounted to \$4,683,306 for the first six months of 1950, and \$4,493,345 for 1949.

LEHIGH PORTLAND CEMENT CO., Allentown, Penn., for the six month period ended June 30, has given below the statement of income:

	1950	1949
Sales	\$19,196,631	\$17,630,529
Net before taxes	4,598,564	3,936,554
Fed. income tax	1,805,000	1,550,000
Net profit	2,793,564	2,386,554
Var. com. share	\$2.93	\$2.51
No. of com. shares	950,780	950,750

LONGHORN PORTLAND CEMENT CO., San Antonio, Texas, reported a net profit of \$724,815, or \$1.45 per common share of 499,160 shares, for the first six months in 1950, as against \$569,312 net profit, or \$1.14 per share, in the same period for 1949.

Exhibitors at Public Works Equipment Show

AMERICAN PUBLIC WORKS ASSOCIATION has issued a list of exhibitors planning equipment displays at the 1950 Public Works Congress and Equipment Show. This show is expected to draw 1200 public works engineers and administrators to New York City Oct. 15-18. Among exhibitors listed are Aeroil Products, Inc., Allis-Chalmers Mfg. Co., Austin-Western Co., Caterpillar Tractor Co., Conveyor Co., Inc., Dempster Bros., Inc., Gar Wood Industries, Inc., Heil Co., International Harvester Co., Michigan Crane & Shovel Co., N. P. Nelson Iron Works, Inc., Nichols Engineering & Research Corp., Syntro Co., and Walter Motor Truck Co.



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CARLISLE, PA.

Manufacturers' News

Caterpillar Tractor Co., Peoria, Ill., announces that first steel erection at the new plant at Joliet, Ill., began on August 8, and it is planned that final assembly operations from component parts produced by Caterpillar and the present subcontractors will start before the building is completed and the necessary machinery for fabrication is installed.

General Electric Co., Schenectady, N. Y., announces that the ten-car exhibit train "More Power to America Special," has started west on the second lap of its nationwide tour and will visit 29 key midwestern industrial centers before heading south, down the Atlantic coast.

Muehleisen Perlite Process, Inc., Fort Worth, Texas, announces the establishment of a sales office in Akron, Ohio, to handle sales of Muehleisen perlite process plants in the United States and Canada. W. M. Lonas, former manager of the Stock Grip Co., Chicago, Ill., and the Buckeye Sand and Gravel Co., Bellair, Ohio, will handle sales from this office. A. G. Ensenat, New Orleans, La., has been appointed export agent.

Link-Belt Co., Chicago, Ill., announces that a separate public relations department has been established, headed by Harlan B. Collins, secretary, and Russell B. Kern, who has been supervising public relations activities, which have been part of the advertising department. Mr. Kern will continue as editor of *Link-Belt News*. The advertising department, under the direction of Julius S. Hoff, advertising manager, has been strengthened by the appointment of Bertram V. Jones as executive assistant advertising manager. Mr. Jones will be assisted by John F. Kelly, assistant advertising manager.

Detroit Diesel Engine Div., General Motors Corp., Detroit, Mich., announces the appointment of Fred Winn, Jr., as sales representative for the Diesel Power Co. distributor of Oklahoma City and Tulsa.

Goodall Rubber Co., Philadelphia, Penn., has announced the retirement of O. C. Jacobs as manager of the Pittsburgh branch after 28 years of service with the company. Edward LeB. Marshall, who has been with the company for several years, succeeds Mr. Jacobs as manager of the Pittsburgh branch.

Chase Bag Co., Chicago, Ill., announces the retirement of H. H. Kanatzer, Sr., manager of the Hutchinson, Kan., sales branch, on his 40th anniversary with the company.

Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York, N. Y., has been appointed national distributor for the welding industry of the recently introduced Prepo torch.

Mack Trucks, Inc., New York, N. Y., has announced the election of W. H. Schneider as vice-president-comptroller, succeeding J. E. Savacool, who has retired. Mr. Savacool, who will be retained as an executive consultant on financial matters, joined the company as a cashier in 1913, and was promoted to comptroller in 1918, which position he has held until his retirement. Lester E. Reeve has been appointed special assistant on financial matters to E. D. Bransome, chairman and president of the company.

A. Leschen & Sons Rope Co., St. Louis, Mo., has announced the appointment of Russell J. Dickson as district manager for the Chicago territory which comprises Minnesota, Wisconsin, Michigan, northern Illinois and Indiana, and eastern Iowa. He succeeds Mark Arnold who has retired after 47 years of continuous service with the company.

Process Industries Engineers, Inc., Pittsburgh, Penn., announces the formation of a manufacturing division to accommodate demands for fabrication of specially engineered equipment for the chemical, petroleum, food and allied industries.

The R. F. Goodrich Co., Akron, Ohio, announces that John L. Collyer, chairman and president of the company, has been awarded an honorary degree of Doctor of Laws by Marietta College, Marietta, Ohio.

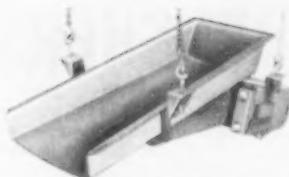
Davey Compressor Co., Kent, Ohio, has announced the election of Paul H. Davey, Jr., as vice-president in charge of production. He has been production manager of the plant for the past two years. Fred C. Keisser has been appointed export field manager and general assistant to R. E. Howard, export manager. He will be in charge of sales activities in Cuba, South and Central America. Steven R. Medin has been named export staff translator and linguist.

General Refractories Co., Philadelphia, Penn., announces the election of James P. Raugh as a vice-president of the company. He has been with the sales force since 1928, and was general sales manager when called to active duty by the Navy in 1942. He returned to the company in 1945 as general works manager which position he held until his present appointment. Harry T. Graham has been appointed general sales manager. He joined the company in 1937 and has been assistant general sales manager since 1949. S. S. Furst, formerly general sales manager, has been appointed assistant to the vice-president in charge of sales.

The Heil Co., Milwaukee, Wis., has appointed Robert G. Macdonald as director of industrial relations. Announcement has also been made of a 15-month training program for new employees to acquaint them with the various divisions and to prepare them for work in engineering, sales and administrative developments in the field.

FOR YOUR FEEDING, CONVEYING AND SEPARATION PROBLEMS

SYNTRON

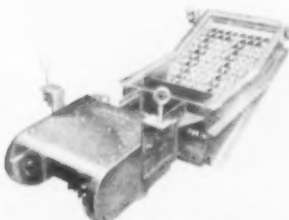


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WILL HANDLE — most all types of Bulk materials — from light, fine powders to heavy, coarse lumps — hot or cold — wet or dry.

AT — variable controlled rates from pounds to hundreds of tons per hour.

TO — crushers, driers, ball mills, belt conveyors, etc.



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Both Feed and Scalp With One Unit

3600 vibrations per minute move bulk materials at the desired rate — a turn of the control knob provides from a trickling dribble to a gushing torrent — over plain troughs, grizzly bars or screen sections. No gears, cams, speed reducers, etc.



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No Motors, Gears or Other Mechanical Wearing Parts

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Permanent strength and operating efficiency is engineered into these crushers at every vital point. Farrel-Bacon will provide industrial units or completely designed and equipped plants, including screens, elevators and conveyors. Also other types of mine, quarry, sand and gravel plant machinery. Write for complete information.

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ANSONIA, CONNECTICUT

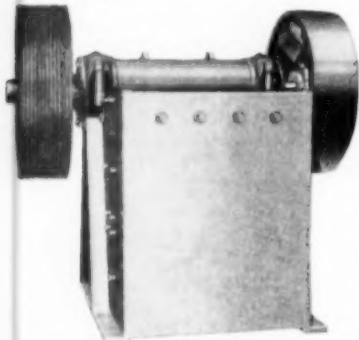


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JAW CRUSHERS

Jaw crushers... the balancing unit in the material reduction circuit and one of the most important factors affecting the final cost of the finished product. Rogers crushers, in 18 sizes, are individually designed and correctly proportioned with long crusher jaws placed at the correct angle to secure superior crushing action, greater capacity, less slippage, less wear and less replacement costs. Bearing sizes are from two to three sizes larger than normally recommended... shaft diameters are likewise oversize, assuring freedom from breakdown and long, trouble-free service.



PRIMARY CRUSHERS IN 6 SIZES
SECONDARY CRUSHERS IN
12 SIZES

● Write for this folder on Rogers Jaw Crushers for more complete information. If you have a specific problem, consult our Engineering Department, no obligation.



ROGERS IRON WORKS CO.

JOPLIN, MISSOURI



Allegheny Ludlum Steel Corp., Pittsburgh, Penn., has approved a new \$23,600,000 plant improvement program to be completed in the next three years. Principal need for the new program, according to a company report, is to keep manufacturing facilities in step with ever changing and increasing demands for high alloy steels and electrical steels. Improvements include a new hot strip mill and additional cold rolling facilities at the Brackenridge plant and additional cold rolling equipment at the plant at West Leechburg, Penn. The project also calls for the erection of a new research laboratory near Brackenridge, Penn.

Pettibone Mulliken Corp., Chicago, Ill., announces the acquisition of Hammerrills, Inc., St. Louis, Mo., manufacturers of Bulldog hammermills, as a wholly owned subsidiary corporation. C. M. Bindner, president, and T. A. Oberhellmann, vice-president and chief engineer of Hammerrills, Inc., will continue in the same capacity under the new ownership. Mr. Bindner, who has been associated with the hammermill manufacturing industry for over 30 years, started Hammerrills, Inc. in 1947. Mr. Oberhellmann has been associated with the industry for over 25 years in engineering and design and joined Hammerrills, Inc., in 1947. Headquarters for the company has been moved from St. Louis to the main office and factory of Pettibone Mulliken Corp. in Chicago, Ill.

Cummins Diesel Sales Corp., Chicago, Ill., has opened a branch in Peoria, Ill., to serve trucking, mining, petroleum, and industrial needs in Central Illinois and part of Iowa, in an area extending from west of Des Moines, Iowa, to the Illinois-Indiana line. Edward Sandtner is manager of the branch. Marshall Shaw is the sales engineer, and Harry Krusinger is parts manager.

The Bay City Shovels, Inc., advertisement on page 45 of the August, 1950, issue of Rock Products, announcing the new 1-cu. yd. convertible excavator, listed it as a 15-ton crane whereas the correct crane rating is 20-tons capacity.



HAISS CLAMSHELL BUCKETS

Quality
Since 1890

Excavating • Trenching • Dredging • Rehandling

Capacities 1/4 to 3 Yds. . . . Ask for Bulletin No. H-850

GEORGE HAISS MFG. CO., INC. division of PETTIBONE MULLIKEN CORP.

141st to 144th St. on Park Ave. 4700 W. Division St.
New York 51, N. Y. Phone Mott Haven 5-2200 Chicago 51, Ill. Phone Spaulding 2-9300



NEW YORK CHICAGO CEDAR RAPIDS

Hyster Co., Portland, Ore., has placed Raymond L. Howerton in charge of tractor equipment promotion. He was formerly associated with the Lincoln Electric Co. as dealer manager in the Pacific Northwest. Announcement has also been made that J. P. Waite, Inc., Milwaukee, Wis., has been named representative for industrial materials handling trucks in eastern Wisconsin and northern Michigan.

Fleming Mfg. Co., St. Louis, Mo., has opened a new division to be known as the bin and batcher division which will handle material handling equipment for the concrete products and ready-mixed concrete industries, such as bins, batching plants, bulk cement plants, bucket elevators, belt conveyors, etc. John F. Van Way has been placed in charge of this division. He was formerly connected with the C. S. Johnson Co., and the Erie Steel Construction Co.

General Electric Co., Schenectady, N. Y., has announced the appointment of D. E. Moorhead as administrative assistant to W. H. Henry, manager of the small and medium motor divisions. O. F. Vea has been named manager of sales, and F. R. Hornby has been made manager of engineering. They will make their headquarters at the Schenectady, N. Y., plant.

Chase Bag Co., Chicago, Ill., announces that J. P. Widlar, manager of the Denver, Colo., sales office, has been appointed sales manager of the Kansas City branch territory. Although the Denver sales office activities will continue under Mr. Widlar's supervision, his headquarters will be in Kansas City. John A. Sutherland, a member of the New Orleans sales force for the past few years, has been made sales manager of the New Orleans branch. His territory includes eight states in the South and Southeast with New Orleans as his headquarters.

United States Rubber Co., New York, N. Y., has appointed Nils W. Swenson as assistant manager of branch sales for the mechanical goods division, with headquarters in New York, N. Y. He was formerly manager of mechanical goods sales for the Buffalo, N. Y., branch.

Rucyrus-Erie Co., South Milwaukee, Wis., has announced the appointment of Henry J. Vines as Central sales manager, with headquarters in Chicago, Ill. Formerly district sales representative for the New England territory, Mr. Vines succeeds his brother, Fred D. Vines, who has resigned.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has appointed Allen P. Beckloff manager of the tubular products division. He was formerly manager of the tubular products department of the plant in Cleveland and succeeds R. W. Burt, recently appointed Chicago plant sales manager.

"SUBWAY" AIR HOSE

*For
Lower Hose
Replacement
Costs on Jobs
Like This!*



WRAPPED DUCK
CONSTRUCTION
Sizes 1/2" to 1 1/2"

A Goodall "Standard of Quality" hose, with a reputation for extra strength, toughness and durability . . . to keep heavy-duty air tools on the job longer. Red rubber cover is highly resistant to severest abrasive wear. Balanced construction assures equally long life for tube, carcass and cover . . . a big saving in hose replacement costs. Light weight, flexible, easy to handle. Available in lengths up to 50 feet.

Prompt Delivery to Your Quarry From a Nearby Goodall Branch



GOODALL RUBBER COMPANY

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PERFORATED METAL SAND AND GRAVEL SCREENS

Manufactured exactly to your specifications
Any size or style screen, in thickness of steel
wanted with any size perforation desired.

We can promptly duplicate your present screens at lowest price

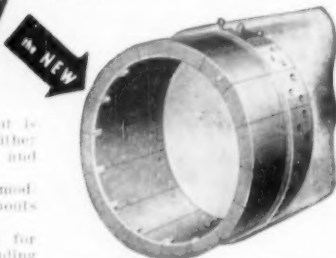
CHICAGO PERFORATING CO.
2437 West 24th Place
CHICAGO 8, ILLINOIS
Virginia 7-6757



PYRASTEEL

PYRASTEEL's amazing record of service is demonstrated by the old type Kiln Ring, shown at left, which withstood high temperatures in a large cement plant in Dallas, Texas, for over 11 years.

This solid ring casting, recently scrapped, weighed 4200 lbs. Today's segmented type Kiln End of the same size would save at least one ton in weight, and about \$1000 in cost.



Over 70% of the annual cement output is produced in plants that now are using either or both of our alloys, PYRASTEEL and EVANSTEEL.

Durable PYRASTEEL Kiln Ends enable modern cement plants to avoid costly burnouts and shutdowns.

PYRASTEEL is economically adapted for many other high heat applications, including conveyor screws, clinker coolers, feed pipes, and drag chains.

Write for PYRASTEEL Bulletin

Chicago Steel Foundry Co.

Kedzie Ave. & 37th St., Chicago 32, Ill.
Makers of Alloy Steel for Over 50 Years

We invite You to visit our
BOOTH No. 200A
at the
CHICAGO METAL SHOW
October 23-27

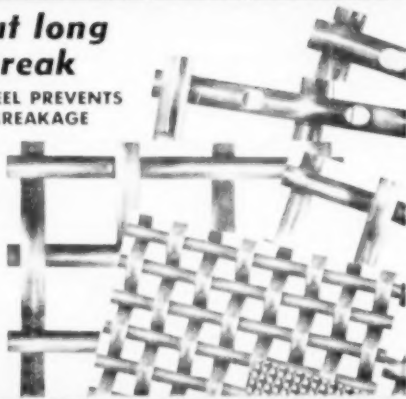
CLEVELAND VIBRATING SCREEN SECTIONS

• will wear out long
before they break

NEW SPECIAL STEEL PREVENTS
PREMATURE BREAKAGE

Cleveland Wire has developed a special steel screen with an increased resistance to abrasion, guaranteed to give longer service life to your vibrating screen sections. It reduces premature breakage of wires because it incorporates an extra tough, hard surface. But despite enough to carry the abuse of heavy-duty vibrating action. Results are higher tonnage and longer screen life at a lower price to you.

Write for Bulletin No. 11. There is a CLEVELAND WIRE SCREEN for every purpose.



THE CLEVELAND WIRE CLOTH & MFG. CO.
3576 E. 78th STREET • CLEVELAND 5, OHIO

Traylor Eng. & Mfg. Co., Allentown, Penn., announces that Joseph M. Wolfe has been appointed assistant to the chief engineer. He was formerly associated with Allis-Chalmers Mfg. Co., Milwaukee, Wis., which he joined in 1935 after graduating as mining engineer from Lehigh University. From 1940 to 1945 he was sales engineer with Allis-Chalmers on mining and cement manufacturing equipment in Argentina and Bolivia. He returned to Milwaukee in 1945 and devoted the next few years exclusively to machinery for the cement industry.

Sterling Electric Motors, Inc., Los Angeles, Calif., has announced the appointment of Alan J. Bronold as sales manager of the domestic and international sales organization. He succeeds Allen Adams who has retired from active sales management due to illness but who will continue as an officer and secretary-treasurer of the company. Mr. Bronold is a graduate electrical engineer of Bliss Electrical School and business administration at Northwestern University, and is also a Westinghouse graduate student, having received his B.S.E.E. in commercial electrical engineering. He was associated with the Vacuum Oil Co., prior to 1926, and has been associated with the Westinghouse Electric Corp. since that time, serving in sales and executive capacities. He was assistant general sales manager in charge of national sales for the Sturtevant Division of Westinghouse just prior to joining Sterling Electric Motors.



Alan J. Bronold

Iowa Mfg. Co., Cedar Rapids, Iowa, has acquired the complete inventory, manufacturing rights and patents on the line of double impeller impact breakers, vibrating screens, roll crushers and feeders, formerly made by New Holland Mfg. Co., Mountville, Penn. Personnel included are V. E. Despard, Jr., former vice-president and general manager of New Holland and J. D. Pfahl, assistant to the sales manager. Bud H. Kessler, New Holland chief engineer and four other New Holland engineers are now part of the Iowa engineering department at Cedar Rapids.

D-A Lubricant Co., Inc., Indianapolis, Ind., has appointed Russell B. Swanson as sales and service representative for the southern Minnesota territory, with headquarters in Minneapolis.

Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y., has announced the appointment of Charles D. Cashman, mining engineer, North Bay, Ont., Canada, as distributor in Canada, where he will cover the mining and quarrying accounts.

Continental Gin Co., New York, N. Y., Industrial Division, has opened a sales office in New York to take over all sales and engineering in the North-eastern territory. A. W. Gotta, formerly of Robbins Engineering Division, has been appointed branch manager, and W. E. Robinson, consultant engineer, has been appointed sales engineer.

Nordberg Mfg. Co., Milwaukee, Wis., has appointed James A. Friend as senior vice-president. Formerly vice-president and general purchasing agent, Mr. Friend succeeds F. Howard Kilberry who has resigned to become a management consultant in charge of the Superior Engine Division of National Supply Co., Springfield, Ohio. Floyd T. Finley has been appointed general purchasing agent of the Milwaukee division to succeed Mr. Friend. D. A. Cheyette, vice-president of the crusher division, has been elected a member of the board of directors. Arthur W. Mueller has been appointed assistant controller.

Spray-O-Bond Co., Milwaukee, Wis., announces that the Ideal Cement Stone Co., Omaha, Neb., has been appointed distributor for the concrete plasticizer and other products of the company in the territory comprising the entire state of Nebraska and a portion of Iowa.

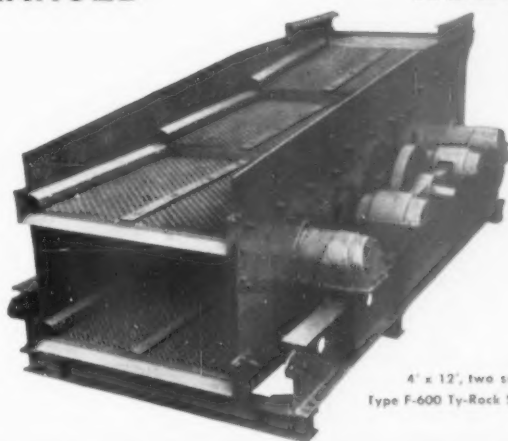
International Harvester Co., Chicago, Ill., announces construction of a new \$5,000,000 service parts depot and machine transfer in Broadview, a suburb of Chicago. The new building will contain more than 1,100,000 sq. ft. under one roof, and is expected to be completed the latter part of 1951. It will serve as a wholesale parts distribution center for district sales offices and branches and retail dealers in Illinois, Indiana, western Michigan, southern Wisconsin, eastern Iowa, and northern Kentucky.

Clinton Machine Co., Clinton, Mich., has purchased a new factory in Maquoketa, Iowa, adding 120,000 sq. ft. of floor space to its facilities for manufacturing the Clinton engines. Announcement has also been made of the appointment of Charles B. O'Neill as executive vice-president in charge of production, and Charles W. Hamilton as sales manager. Don Thomas, president and chairman of the board, had been directing sales in addition to his other duties, prior to the appointment of Mr. Hamilton.

A. B. Farquhar Co., York, Penn., manufacturer of portable or permanent conveyors, has announced the appointment of William L. Allen as conveyor sales and service representative in the Albany, N. Y., territory. He was formerly with the F. S. Converse Co.

Hunt-Spiller Mfg. Corp., Boston, Mass., manufacturer of iron and steel castings, announces that Harlow F. St. Pierre, formerly assistant sales manager, has been appointed manager of the industrial sales department.

YOU CAN DEPEND ON TY-ROCK SCREENS BALANCED RUGGED



4' x 12', two surface
Type F-600 Ty-Rock Screen

THE W. S. TYLER COMPANY
CLEVELAND 14, OHIO
Manufacturers of Woven Wire Screens and Screening Machinery

More Yardage with Less Labor



The Sauerman Slackline Cableway pictured above started this gravel pit 470' x 300' several years ago. It is digging now at a depth of 80' and producing about 60,000 cu. yd. a month.



Mexico's newest cement mill uses a Sauerman Power Scraper to dig clay from a hill and move this clay to a surge pile feeding into a hopper at the washmill.

How a SAUERMAN machine cuts costs--

MANY jobs of earthmoving, surface mining and stockpiling can be simplified and a great deal of money saved by using either a Sauerman Power Scraper or Slackline Cableways because in this way you combine digging, hauling and disposal of materials in one operation.

First cost of a Sauerman machine is reasonable, maintenance expense is small, and the simplicity of operation permits easy one-man control of even the largest installation.

Sauerman engineers will gladly study your digging or stockpiling problems. Their advice may save you money and will be given free.

Rope Haulage
Equipment
Specialists
Since 1909

Write for new Scraper and Cableway Catalogs.

SAUERMAN BROS., Inc.

530 S. Clinton Street

Chicago 7, Illinois

THE WIRE ROPE

You Can
Depend on—



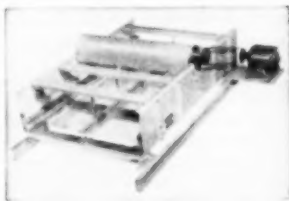
HERCULES (Red-Strand) Wire Rope always lives up to its widespread reputation for outstanding performance... even under the severest conditions. For safe and economical operation, specify **HERCULES** ("Red-Strand").

Made only by—

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5909 Kennerly Ave., St. Louis 12, Mo.
Est. 1857
New York 6 • Chicago 7 • Birmingham 6
Denver 2 • Houston 3 • Los Angeles 21
San Francisco 7 • Portland 9 • Seattle 4

FROM GRAVEL TO YOUR FINEST SAND SEPARATIONS—OR STONE TO YOUR FINEST SCREENINGS, UNIVERSAL OFFERS BETTER SCREENING AT A LOWER COST!



Yes, the initial cost of this Screen is low—but of greater importance is its dependability, low operation and maintenance costs. That's where the Universal is a true money-maker!

Write today for prices,
and Catalog No. 109 on
Screens and Screening.

UNIVERSAL VIBRATING SCREEN CO.

Link-Belt Co., Chicago, Ill., has advised us that we were in error in announcing recent appointments by the company in the May issue of **ROCK PRODUCTS**. The announcement should have read: David E. Davidson has been elected vice-president of sales for the Link-Belt Co., and Eugene P. Berg, formerly assistant general manager of the Pershing Road plant, to succeed Mr. Davidson. All officers who served last year have been reelected. Columbus Basile has been elected vice-president of operations for the Link-Belt Speeder Corp., Chicago. W. Lehti has been reelected president of the corporation; G. H. Olson, vice-president, and H. E. Kellogg, treasurer and secretary.

Electric Steel Foundry Co., Portland, Ore., recently held open house at its new office and warehouse in Eugene, Ore., serving the area from Salem south to Dunsmuir, Calif. L. F. Maxwell is manager of the branch.

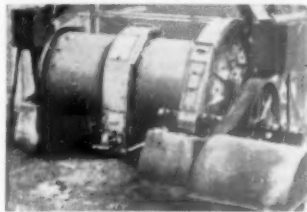
Galion Allsteel Body Co., Galion, Ohio, has appointed V. K. Gaston as director of sales. He has been Western regional sales manager for the past 20 years. R. H. Stevens, formerly Southern regional sales manager, has been appointed sales manager.

Caterpillar Tractor Co., Peoria, Ill., has announced formation of the Caterpillar Tractor Co. Ltd., a wholly owned British subsidiary for the purpose of engaging in the business of procuring, inspecting, storing and shipping British-made Caterpillar parts to dealers in the United Kingdom and other countries. Wallace J. Bornholdt, purchasing agent, has been named managing director of the organization; Wayne H. Beck, formerly parts control manager, has been made merchandise manager; and Wayne R. Thomson, planning staff engineer, has been appointed head of the technical and inspection department. They and their families left Peoria recently to establish residences in England.

Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J., has announced removal of its New Orleans office and warehouse from 1009 Camp Street to 920 Calhoun Street.

H. K. Porter Co., Inc., Pittsburgh, Penn., has announced the appointment of Henry M. Sossaman as general sales manager of the Quaker Rubber Corp., Philadelphia, Penn., a division of the company. He has been with the Quaker firm for 22 years, starting as a salesman in charge of the Florida sales district. Charles E. Dugan has been named to succeed Mr. Sossaman as assistant general sales manager; Jack R. Lewis has been appointed assistant sales manager; Thomas L. Durkin, manager of contract sales; Art M. Lowrey, Philadelphia district sales manager; and Benjamin Shawcross, manager of the moulded hose department.

GET BETTER, CHEAPER SPECIFICATION SANDS



WITH MARCY C-P-D Rod Mills

On Government dam projects and in industrial sand and gravel plants, the New MARCY Center Peripheral Discharge Rod Mills are producing Specification Sands with fineness modulus variations of 0.10.

Other advantages include gradation flexibility, cubical particle shape, and continuity of operation. Write for list of MARCY C-P-D installations on specification sands and full information.

Mine & Smelter

SUPPLY COMPANY
DENVER, COLORADO • CHICAGO, ILL. • BOSTON, MASS. • NEW YORK



In plants handling Cement, Lime, Gypsum, Sand, Gravel, Crushed Stone, etc. the **WEIGHTOMETER** is used for fast accurate production.

WEIGHTOMETER gives a continuous, automatic, and accurate weight record of materials in transit at an extremely low operating cost. All producers of bulk materials handled by belt conveyors need this dependable check on production figures supplied by **MERRICK WEIGHTOMETER**.

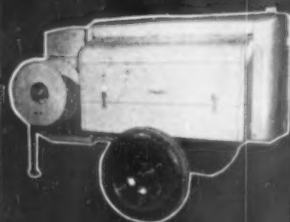
Send for Bulletin 375

Merrick Scale Mfg. Co.
Passaic, New Jersey

Compressor Users:

Get the facts
about the new

SMITH 105-P Compressor



**Packs a wallop
FOR POWER!
Costs less to Operate!**

Powered with the new Chrysler Ind. 15 Industrial Engine with 227 Cubic inch displacement. Delivers 185 cubic feet per minute. Sodium cooled valves and Stellite valve seats in engine. Stainless steel disc type valves and Manganese Bronze seats in compressor. Smooth even flow of air. Self starter, battery ignition, voltage regulator, large radiator capacity with thermostat for quick warm-up. Heavy duty with light weight (2100 lbs.).

Write for literature and prices.

Also write for information on
The New SMITH
MODEL 70-P COMPRESSOR

SMITH Air Compressors

Gordon Smith & Co. Bowling Green, Ky.
485 COLLEGE STREET

Bailey Meter Co., Cleveland, Ohio, has announced the following assignments to its staff of engineers. Branch offices: Denver, Colo., C. R. Owens; Kansas City, Mo., R. L. Hart; Philadelphia, Penn., W. B. Martin; St. Paul, Minn., V. W. Grant and J. T. Wilson. Main office, engineering department: F. D. Christliff, G. N. McComb, V. W. Parsons, R. E. Pocock, and C. D. Shanks. Research department: R. Q. Brown, P. C. Hungerford, G. R. Markow, and R. F. Sutton. Sales department: P. K. Bolyard and R. R. Walker.

Koppers Co., Inc., Pittsburgh, Penn., has announced the appointment of Dr. E. W. Volkmann and Dr. F. L. Jones as assistant managers of the research department. Dr. Volkmann has been assigned to the laboratory and development sections, and Dr. Jones has been named supervisor of the research administration and patents sections.

Hewitt-Robins, Inc., New York, N. Y., has appointed C. E. Thurston & Sons, Inc., Norfolk, Va., as distributor of Hewitt Rubber Division products in the Norfolk area.

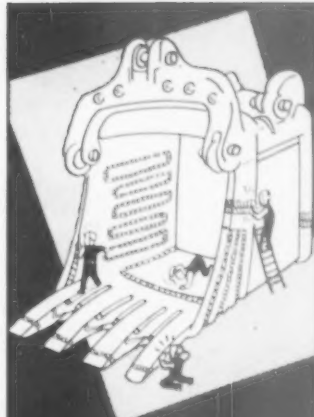
Dravo Corp., Pittsburgh, Penn., has opened a sales office in Boston, Mass., headed by R. M. Barnes, northeastern sales and service manager of the heating department. The territory covered by this office includes Worcester county and the state of Rhode Island.

Koehring Co., Milwaukee, Wis., has appointed the following distributors: Construction Equipment Co., Birmingham, Ala., for Alabama and northwestern Florida; Tom W. Carpenter Equipment Co., Inc., Amarillo, Texas, for the western part of Texas comprising counties north of and including Cochran, Hockley, Lubbock, Crosby, Dickens and King; and Sioux Road Equipment, Inc., Sioux Falls, S. D., for the state of South Dakota.

Denver Equipment Co., Denver, Colo., announces the appointment of Douglas E. Newton as general sales manager in charge of sales and sales promotion. For the past two years he has been in charge of the plant in Colorado Springs, Colo. Previously, he served with the engineering, order, ore testing, advertising and sales divisions of the company. A graduate of the Colorado School of Mines with a degree in metallurgical engineering, Mr. Newton recently completed a tour of Europe, Africa, South America and Canada, to familiarize himself with the operations of the branch offices and subsidiary companies and to meet the company's customers in these countries.



Douglas E. Newton



Repair Worn Buckets

with

MANGANAL

U.S. PATS. 1,876,738; 1,947,167; 2,021,945

11% - 13½%

Manganese-Nickel Steel

**... the Toughest Metal Known.
Not Harmed by Heat!**

- MANGANAL speeds repairs ... practically eliminates build-up welding time.
- BUCKETS economically repaired with MANGANAL products often outlast new ones.
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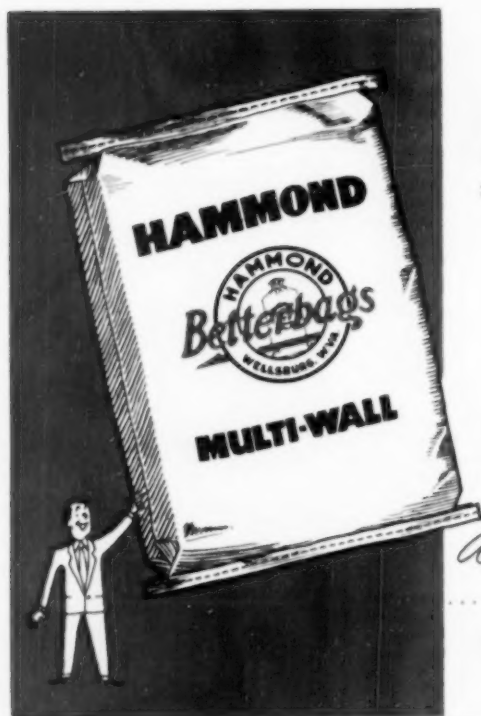
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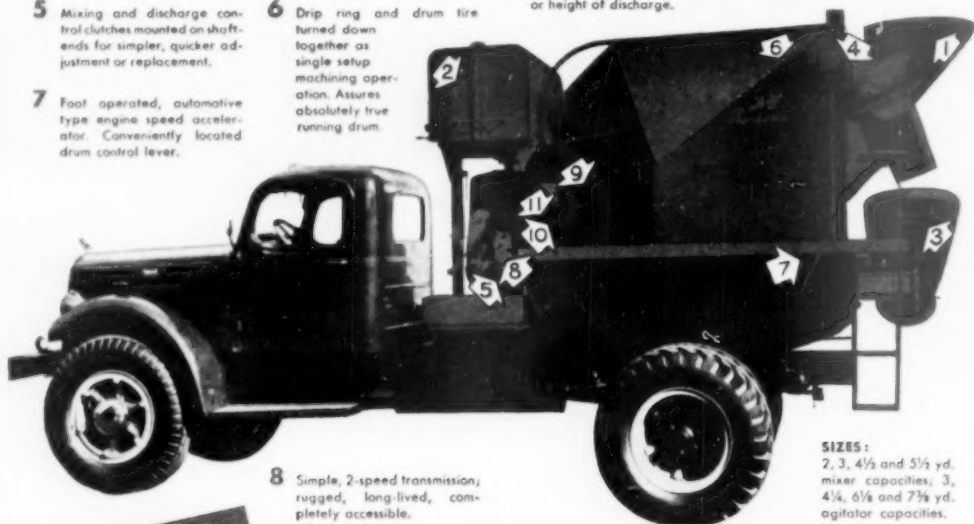
A SECTION OF ROCK PRODUCTS

CONCRETE UNITS · READY-MIXED CONCRETE



Central mixing plant on Pennsylvania Turnpike bridge project

- 1 Simplified, full-floating-charging hopper assembly. Improved seal design assures low maintenance cost.
- 2 Improved overflow-type water tank; non-breakable gauge glass and non-freeze valves.
- 3 Rigid, quick-detachable chute support bracket. Easily swung clear when discharging into hoist buckets; quickly adjustable for slope of chute or height of discharge.
- 4 Renewable drip ring is quickly, easily, accurately replaced and locked on drip ring flange by 12 cap screws.
- 5 Mixing and discharge control clutches mounted on shaft-ends for simpler, quicker adjustment or replacement.
- 6 Drip ring and drum tire turned down together as single setup machining operation. Assures absolutely true running drum.
- 7 Foot operated, automotive type engine speed accelerator. Conveniently located drum control lever.



SIZES:
2, 3, 4½ and 5½ yd.
mixer capacities; 3,
4¼, 6½ and 7¾ yd.
agitator capacities.

- 8 Simple, 2-speed transmission; rugged, long-lived, completely accessible.
- 9 Chain-driven drum reduces weight without loss of strength.
- 10 Trunnion bearing design, with double race bearings for maximum flexibility.
- 11 Fabricated, all-steel drum-head. Conical section with steel reinforcing ribs absorbs shocks.

NEW!

THE 1950 LINE OF *BLUE BRUTES* HI-UPS Gives You Every Money-Saving Feature!

Men like you helped design this newest Blue Brute Hi-Up! Ready-mix operators throughout the world were consulted, and their very practical suggestions were valuable aids to Worthington-Ransome's century-plus of experience.

The result is an ultra-modern truck mixer — not only a technical triumph in lightness of weight without loss of strength, but an on-the-job performer unequalled for trouble-free operation, easy accessibility of wearing parts and low cost maintenance. The following typical testimonial shows you why —

Our trucking foreman is particularly com-

plimentary of the new Hi-Up's well designed transmission system, including the transmission itself. Our shop service men are complimentary of the unit's ability to properly mix and discharge low slump concretes. We complement you on a well engineered and well designed truck mixer.

SOUTHERN MATERIALS CO., INC.
J. W. Roberts, Vice President

Give the new Hi-Up's features a good going over — one by one. You'll agree that they add up to more concrete at lower cost — and that there's more worth in a Blue Brute. For further facts, see your

nearby Worthington-Ransome Distributor, or write for Bulletin.

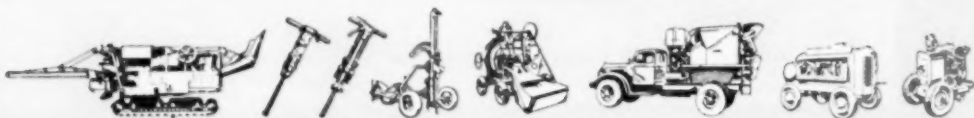
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BLUE BRUTES**



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INDUSTRY NEWS

Masonry Association Meeting

CONCRETE MASONRY MANUFACTURERS ASSOCIATION held its general membership meeting July 25 at the Rodger Young Auditorium, Los Angeles, Calif. Albyn Mackintosh, consulting engineer, reported on the newly proposed building code requirements for reinforced masonry in Los Angeles. Mr. Mackintosh also gave an analysis of the William A. Grindle sponsored standard construction for one-story dwellings which has been presented to the Bank of America, Pacific Coast Building Officials Conference, Federal Housing Administration, Portland Cement Association and Concrete Masonry Manufacturers Association for their consideration and approval.

Also included in the program was a talk by Sam Hobbs, Portland Cement Association (Los Angeles office) engineer, on the fire rating for concrete block. Mr. Hobbs then reported on a meeting held with the Los Angeles Building & Safety Department.

Receives Safety Award

UNIVERSAL CONCRETE PIPE CO.'S Dothan, Ala. plant has been awarded a safety certificate by the American Mutual Liability Insurance Co. During the last four years the plant has had only one minor lost-time accident.

N.C.M.A. Exposition

NATIONAL CONCRETE MASONRY ASSOCIATION has announced that the 31st annual meeting of the association will be held January 22-25, 1951, at the Cleveland Public Auditorium, Cleveland, Ohio, in connection with

the 7th Concrete Industries Exposition. Due to increased facilities for booth space, and judging from advance reservations, the exposition is expected to be the largest ever held.

Develop New Concrete

UNIVERSITY OF MINNESOTA RESEARCHERS, in co-operation with St. Paul Union Stockyards Co., are working to perfect a new type of concrete that will be fireproof, as strong as wood, and almost as elastic as rubber. Joseph Wise, technology professor, stated that the compressed concrete has stood ten times the strain needed to smash ordinary concrete planks, and that a concrete plank 1-in. thick and 8-ft. long was deflected 12 in. before it broke, whereas an ordinary concrete plank would break after a 1/2-in. deflection.

Cover Picture

THE TEMPORARY concrete central mixing plant shown is at the site of a new 1540-ft. highway bridge over the Beaver river, 30 miles northwest of Pittsburgh. It is being used during construction of the piers for the bridge which will carry the 67-mile western extension of the Pennsylvania Turnpike to the Ohio state line. About 9000 cu. yd. of concrete will be used for the piers. The mixer shown is supplied with aggregates by crawler crane, and concrete is ferried across the river on small barges.

TULLAHOMA CONCRETE BLOCK CO., Manchester, Penn., has constructed a new plant, with plans to produce a complete line of concrete tile and building block.

DRI-MIX CONCRETE CO., Denver, Colo., has announced plans for the distribution of Dri-Mix in Boulder. Dri-Mix, which is dry-batched material, was developed primarily to meet the needs of the householder, farmer or businessman, for repairing and remodeling, or for small construction projects. The buyer can purchase Dri-Mix in as small a quantity as suits his needs and can choose from Plaster-Mix, Mortar-Mix, Cement-Mix, Sand-Mix or Waterproof-Mix, depending upon the application.

GUS HILLIN, JR., plant manager, has announced completion of the Red-E-Mix concrete plant at Atchison, Kan. The new plant has a capacity of 60 cu. yd. per hour, compared to a maximum of 25 cu. yd. with the old equipment. The plant has a 100-ton capacity hopper with four compartments for sand, gravel, stone and cement. There are three concrete stage silos for additional storage of sand, gravel and stone. In addition to turning out ready-mixed concrete, the company also manufactures a concrete incinerator, and is planning early installation of equipment to turn out concrete block.

O. W. SIMMONS & SON, a Scottsbluff, Neb., contracting firm, has constructed a Bricrete concrete block manufacturing plant. The units, to measure 12 x 8 x 3 in., will be available in natural gray, red, yellow, green or tan. One of the block takes the place of four clay bricks, and only one-third as much mortar is needed, the company states.

READY-MIX CONCRETE CO., Frederick, Okla., established in February, 1949, by Ferrell Givens, Roy Sheumaker and G. H. Givens, has doubled production capacity since that time and now does general contracting in concrete work as well. It also sub-contracts, or supplies direct, mixes for all other builders and contractors on a custom basis.

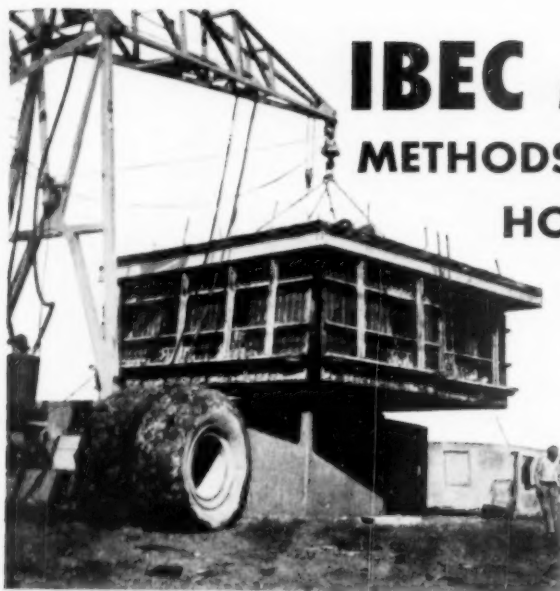
CONCRETE MIX, INC., Rockingham, N. C., a newly-organized company, has added two transit-mixed concrete trucks and a conveyor to its equipment. Walter Dempsey, Walter R. Jones, Jr., and Charlie A. Gillis are incorporators of the new firm. Ben D. Hudson is manager.

VIRGINIA CEMENT BLOCK CO., Virginia, Minn., has added more equipment to its newly-expanded plant for the manufacture of concrete and cinder block. One of the improvements has been the addition of bulk cement facilities, in addition to a new crushing and screening unit for the processing of cinders. T. M. and I. E. Seppi are the owners.

W. J. WETZEL, owner, has announced construction of a ready-mixed concrete plant at Bloomington, Ill., to be operated by Bloomington Builders Supply Co. Equipment will include a loading and dry-mix trestle 17 ft. high.



Booth of C. Gartenmann & Co. at Swiss Fair in Basle, Switzerland, features the uses of Zonolite vermiculite. Floor of the booth is made with a base of vermiculite concrete for different types of floor covering. The rear wall demonstrates various kinds of vermiculite plastering applications, including gypsum and cement plaster for interior and exterior insulation. The ceiling is made of Zonolite acoustical plastic, sprayed and troweled.



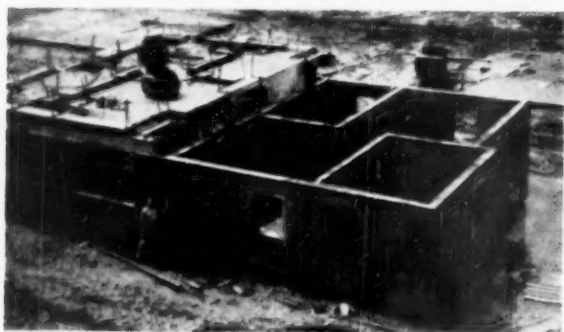
IBEC MASS-PRODUCTION METHODS ACHIEVE NOTABLE HOUSING ECONOMIES

● Imagination and know-how, working with good concrete, have achieved another notable advance. Utilizing what in essence is a mobile production line on the job site, the Ibec Method produces attractive, all-concrete homes, at costs which revalue the home-building dollar.

Heart of the Ibec Method is a 25-ton form used for both exterior and interior walls. A 30-ton crane positions the form on a cast-in-place floor slab. Roof slabs, precast on the ground in tiers, are placed on the house by Billner vacuum lifting device. Monolithic concrete walls in a single operation . . . no shoring, scaffolding, ladders . . . completing in hours what normally takes days.

Recent example is Marshall Manor, a 204-unit, low-cost housing project at Norfolk, Va., where attractive, fire-safe homes, built with Lone Star Cement and lightweight, insulating aggregates, rent for only \$45, a month.

Here is Gibraltar-like, all-concrete construction—impervious to fire, termites, weather, wear. Adaptable to any good architectural design, the Ibec Method stretches the building dollar in the home-owner's favor.

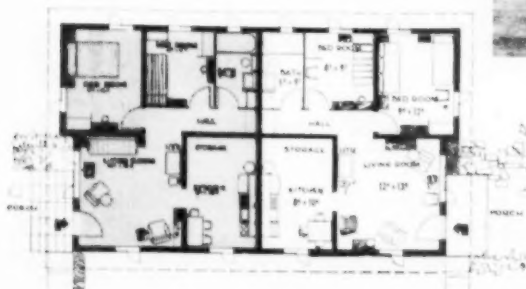


MARSHALL MANOR, Norfolk, Va.

Built by **HENRY CLAY HOFHEIMER II**, Norfolk

Construction Method developed by
IBEC HOUSING CORPORATION,
Affiliate of **INTERNATIONAL BASIC ECONOMY CORP.**,
New York

Built with Lone Star Ready Mix Concrete from:
SOUTHERN MATERIALS CO., INC., Norfolk-Richmond



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LONE STAR CEMENT WITH ITS SUBSIDIARIES IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS. IS MODERN MILLS 27,500,000 BARRELS ANNUAL CAPACITY



Left: Quarry near Vernonia, Ore. is so close to the railroad that special precautions have to be taken to prevent interfering with rail traffic. Right: General view of Smithwick Concrete Products plant; Haydite plant is at right and block plant is visible at left.

Nation's Most Modern Haydite Plant

Smithwick Concrete Products, Portland, Ore., profits from experience of cement industry in adopting long kiln and in utilization of pre-heated secondary air and other devices for higher thermal efficiency

SMITHWICK CONCRETE PRODUCTS of Portland, Ore. was founded in 1946, in which year its modern block plant went into production. Later, the president of the company, S. Carl Smithwick, formed a second company known as the Insullite Block and Supply Co. and a second modern block plant was built in Eugene, Ore. Still later Mr. Smithwick and associates purchased the Eugene plant in its entirety and the name of the company changed progressively to Smithwick Block and Supply Co. and then to Smithwick Concrete Products. Both of these plants were predicated somewhat on the use of pumice as the basic raw material; this material was shipped into the area from central Oregon in the vicinity of Bend.

The third major step in the development of this progressive organization was in the direction of securing a high quality lightweight aggregate having structural characteristics of the highest order in such respects as strength, insulating and acoustical features. This step culminated in the recent official opening of the Northwest's newest and most modern Haydite plant which was constructed near the company's home plant in Portland.

Mr. Smithwick not only is an efficient operator but also has a flair for bringing together an organization in which the key men are highly experienced and able to carry out the operational functions of the company. Paul P. Klemens, vice-president and production manager of the Portland block plant, formerly was with Besser Manufacturing Co. Vice-President Otto C. Frei was formerly president of the Washington-Idaho Lime Products Co. at Orofino, Idaho, and is well known in western portland ce-

ment circles. It was under Mr. Frei's direction that the detailed drawings for the plant were made. He also directed the construction and is the Haydite plant's operating head. The construction contract for this \$250,000 plant was awarded to the Oregon Erecting Co. of Portland.

American Aggregates Co., which controls the trade-name "Haydite,"

Mr. Smithwick first started selling concrete masonry units through a connection with Montgomery Ward Co., Sears Roebuck & Co. and the principal lumber dealers throughout the state of Oregon and southwestern Washington, this sales stunt possibly received more comment both verbally and in the press than most sales efforts. While the new Haydite plant was under construction additions were made to the new office building that tied in with the plant and also with the sales promotion relating to this new product. Alongside his own private offices an assembly hall of modest proportions and modern lines has been constructed. This includes a small, but modern kitchen.

New Plant Dedication

On the opening day of the new Haydite plant the most brilliant galaxy of public officials and commercial and industrial leaders ever to witness the opening of an industrial plant in the northwest assembled for the formal ceremonies, including Governor Douglas McKay of Oregon, Mayor Dorothy McCullough Lee of Portland, contractors, architects and other leaders of the construction field.

Plant Features

The Haydite plant itself has several things about it that have excited considerable comment throughout the country, particularly among the manufacturers of expanded shale. In the first place its 8- x 100-ft. rotary kiln is said to be the largest in the industry. Most similar rotary kilns are smaller, both in diameter and length. From our own knowledge of the Haydite industry we know there are two schools of thought on the subject of long versus short kilns, and both



S. Carl Smithwick, president of Smithwick Concrete Products

after careful scrutiny of the plant's design, construction, and operating personnel, granted Smithwick Concrete Products the exclusive franchise for the Northwest for using the name "Haydite."

Besides having organizational abilities of a high order, Mr. Smithwick has a leaning toward publicity that focuses attention favorably on his plants and their products. Even when

groups have their advocates. The fact remains, however, that from the start of production of this new enterprise the Smithwick company has consistently produced an unusually high quality aggregate as shown by numerous tests of the material conducted by the Washington Department of Highways and by independent laboratories. Mr. Frei summed up his conclusions by stating, "I wish the kiln were 50 ft. longer."

Temperatures reached within the kiln are in the 2200 deg. F. range. Oil for fuel is stored in a 27,000-gal. underground storage tank in which hot water is circulated to fluidize the oil and to aid in its combustion. Instrumentation relating to the small boiler supplying this hot water, and for control of the kiln, was furnished by the Minneapolis-Honeywell Co. The kiln burns about 4000 gal. of fuel oil per 24 hr.

The second feature that stems from portland cement experience is the use of a rotary cooler, 5½ x 50 ft., in which the effluent and hot air that has derived its heat from the clinker is used for secondary combustion in the rotary kiln. The kiln and cooler were made in Spokane, Wash., by the General Machinery Co., with the heavier castings, trunnions, etc., being made in Seattle. The kiln uses oil for fuel for which a Hauck oil burner is provided.

A third and highly important feature is that the plant is entirely dustless, as all sources of possible dust are enclosed in steel housings and are provided with exhaust ducts connected to the collector system. Dust from the kiln and other sources is recovered by a 40-tube Multiclone collector that was manufactured by the Western Precipitation Corp. of Los Angeles. Collected dust is returned to the kiln via two small screw conveyors, one of which receives its feed from a rotary valve under the steel hopper of the Multiclones. The rotary valve is driven by a ½-hp. Century motor. The exhaust fan is a Clamage unit and is provided with water-cooled bearings. The fan discharges to the atmosphere through a tall steel stack.

The raw material, the kiln clinker, and the finished materials are stored in one of four steel silos, each of which holds 600 cu. yd. On top of the silo holding the clinker a Simplicity vibrating screen has been provided. It scalp out a ¾- to 1-in. size that is spouted to ground storage. This is the largest sized Haydite produced here and it is finding a use in monolithic concrete construction.

Crushing Operations

In the production of Haydite at this operation three stages of crushing are involved. The first crushing is at the pit located near Vernonia, Ore., some 40 miles west of Portland. Here the primary unit is an Eagle senior shale crusher made by Eagle Iron Works. This crusher consists of two heavy steel shafts mounted horizontally and



Hot air from cooling clinker in this 5½ x 50-ft. rotary cooler is used as secondary air for combustion in the rotary kiln



Aggregate plant is located conveniently close to block plant; the two silos at left are for storing the finished and crushed Haydite

parallel to each other. Affixed to each shaft are many discs, or "claws," likewise of heavy steel construction. On each shaft are nine claw assemblies, each of which has six teeth. The two shafts rotate toward each other and tend to pull the shale into the unit and literally slash it to pieces. It is driven by a 100-hp. motor and has a capacity of 75 cu. yd. per hr. One of the horizontal shafts runs at 70 r.p.m. whereas the other runs at 25 r.p.m. The minus 4-in. shale from the crusher is loaded to open gondolas and shipped to Portland over the rails of the Spokane, Portland, and Seattle railroad. Electric power is purchased.

The second crushing is at the Haydite plant where the 4-in. shale is reduced to minus 1½-in. by a set of rolls. The third and final crushing,

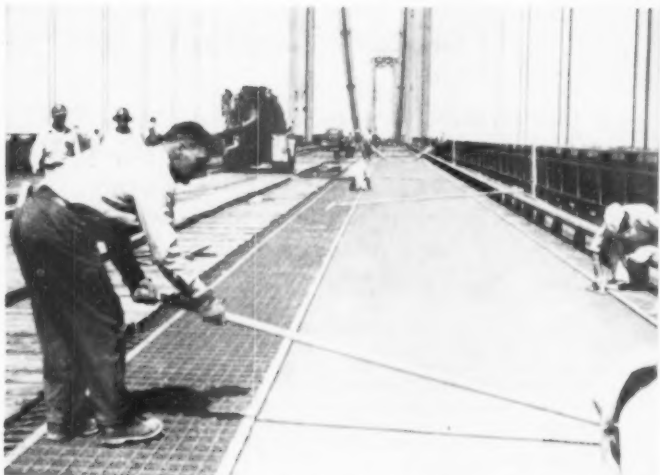
of cooled clinker, is by a 38½ Kennedy-Van Saun reduction crusher. After the clinker has been crushed in the K.V.S. unit it is elevated to a second Simplicity screen mounted on top of one of the silos holding the finished material where plus ¾-in., minus ¾-in., and minus ½-in. products are made. These two sizes and the larger one previously mentioned are the sizes produced. The two silos can load to railroad cars or to trucks. The four silos (23 x 60 ft.) were fabricated in Portland by the Willamette Iron and Steel Co.

Raw Material Excavation

The raw material from which Smithwick Concrete Products makes its Haydite is classed locally as the Keasy formation. It is a carbonaceous



New Haydite plant with kiln in center



Haydite concrete was specified for the deck of the rebuilt Tacoma Narrows bridge

shale which, when first mined, is almost dark blue in color. However, it seems to oxidize very rapidly and by the time a car is loaded and shipped to Portland, the rock is a light gray in color. It is a highly fossiliferous material, relatively light in weight, and while rock-like in appearance is relatively soft and easy to quarry and crush.

The deposit is situated immediately alongside the railroad, and during the preliminary operations of the open pit considerable shuffling of crushing and loading equipment had to be done to operate and not interfere with orderly railroad movements. However, at the time of inspection this phase of the quarrying was about completed. Stripping of the deposit is negligible. A Gardner-Denver duplex compressor supplies air for drilling and

40 percent Atlas explosives are used. A 15-B Bucyrus-Erie shovel is used for loading to trucks for pit haulage. Shipments go out from the pit three times a week so sufficient open gondolas leave the pit each time to keep the plant in Portland running seven days per week for 24 hr. a day. The plant has a capacity of 300 cu. yd. per 24 hr. There are a total of 25 GE motors in the Portland operation.

Product Characteristics

The Haydite produced is reddish brown in color with a hard exterior surface and an interior made up of a large number of small glass-walled cells. The interior is black in color. The expansion ratio of raw material to the finished material is 1 to 1.4. The finer sizes are used in the company's plants for making concrete masonry

units that are of exceptional quality. Car shipments are going out all over the Northwest, with one car going to Alberta, Canada. It has been accepted by the states of Oregon and Washington with several large bridge and building projects now on the drafting boards specifying Haydite. However, its use as an aggregate in some of Portland's ready-mixed concrete plants is still in the pioneering stages.

The most outstanding bridge project in the nation this year, the Tacoma Narrows structure, which is to be the third longest bridge in the world, is using the Smithwick Haydite for the entire deck. The roadway section is of four lanes; the deck is 6700 ft. long and 5½ in. thick. The first deck concrete was poured August 16.

Concrete Products Plant

The concrete block plant at Portland was built in 1946 and is a model of neatness with good housekeeping practices evident everywhere. It features a Besser Super Vibrapac and Clark lift trucks. Nine steam curing kilns are provided steam from a 150-hp. boiler. The five-acre yard is paved.

Construction of the concrete masonry plant in Eugene, Ore., was completed in 1948. The general layout, including the plant, the office building of pumice block, spur facilities, aggregate and cement elevators, closely resembles that of the company's plant at Portland.

The plant adjoins Pacific Coast Highway 99, one of the main arteries of the West. Motorists traveling this highway get an excellent panoramic view of the operation, as the tall neon-lighted pylon of the office building and the towering elevators and storage bins dominate the surrounding area. Not only is the plant location strategic from an advertising and publicity point of view, but its location is ideal from the standpoint of the rail and highway facilities. The major portion of aggregate and cement is hauled by rail, so the company owns a 500-ft. spur track served by the Southern Pacific Railway.

The Eugene plant was one of the first plants in the West to use the front pallet feed device that is now standard equipment with Besser plain pallet Vibrapacs. This has proved to be an efficient and smoothly operating mechanism. The cleaned pallets are delivered to the front of the block machine in steel racks that later hold the green block, the pallets being left there by the strippers. Two L-56 Towmotors deliver the racks to the machine and transport the cubed block to the storage yard, load outbound trucks, etc.

Full racks are delivered to one of six steam kilns that are arranged facing each other—two rows of three kilns each. The kilns each hold 18 racks, or 1296 blocks. Steam is supplied by a Lima boiler that is equipped with a No. 6 fully automatic Ray oil burner.

(Continued on page 71)

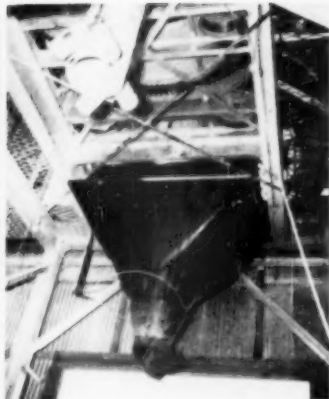
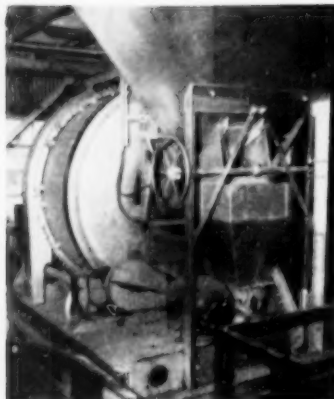


Fig. 1, left: Rear of mixer showing mixer hopper and by-pass chute for dry batching. Fig. 2, center: Bottom view of accumulator hopper and telescopic by-pass chute. Fig. 3, right: Steam generator located on same level as mixer



South elevation of plant under construction, showing general framing and cement elevator



Officials of Richter Concrete Corp. attending Open House ceremonies at the new plant. Left to right: Julian Carson, chief engineer, Julius Warner, general manager, and Louis Richter, president

Central-Mix Plant Designed to Minimize Charging Delays

New plant of Richter Concrete Corp., Cincinnati, Ohio, utilizes 6-cu. yd. collecting hopper with 2-cu. yd. central mixer to regulate batches according to truck agitator capacities; cost-saving design features new plant

ONE OF THE FINEST central-mixing concrete plants in the area was recently put into operation at the Bridgetown yard of Richter Concrete Corp., Cincinnati, Ohio. The new plant was designed to meet the owner's special requirements and available location. The result is a complete new design, highly efficient, producing 60 cu. yd. of premixed concrete per hour with one 2-cu. yd. mixer. This capacity will be increased later with the addition of fully automatic controls for the aggregate batching.

Material Flow

The operation cycle of the entire installation may be followed closely on the yard plan and flow diagram. Aggregates are received by either truck or rail and enter the system at two different points. Truck loads are dumped into a 20-ton grade level hopper, and aggregate flows through a 16-x 16-in. Miami feeder gate onto a 24-in. belt conveyor. This 112-ft. center to center conveyor is driven by a 7½-hp. Link-Belt gearmotor and roller-chain drive at a speed of 200 f.p.m., rated capacity 160 t.p.h. Head and tail pulley bearings are ring sealed anti-friction type, and idlers are 5-in. steel with Timken bearings. The

conveyor is located in a trench also to service five existing trestle storage bins, which hold a reserve of 500 tons of aggregate.

Material is fed from these storage bins by means of five reciprocating plate feeders to the conveyor. This conveyor discharges through a transfer loading leg to a 47-ft. inclined belt conveyor, also 24 in., which runs from a 60-ton capacity truck hopper to the loading leg of a 16-in. super capacity bucket elevator. Hopper receives material either by rail or truck. Top of trestle is floored for truck transit, and trucks can dump either in reserve pockets or hopper. Material is fed from this hopper to the 47-ft. conveyor by means of a Miami feeder gate. All conveyors were made by Webster Manufacturing, Inc., and the belts by Cincinnati Rubber Manufacturing Co.

Aggregate

The boot section of the aggregate elevator is open to prevent any digging action on the buckets and requires no pit. This elevator is built integral with the bin, and has a capacity of 160 t.p.h. It discharges to a remote controlled pivoted distributor, which feeds any one of five aggregate com-

partments. There are storage compartments for fine sand, coarse sand, pea gravel, 1-in. gravel and 1½-in. gravel. Total aggregate storage capacity is 350 tons.

Cement Handling

Cement is received by rail or truck. Rail-delivered cement is unloaded by a 12-in. screw conveyor at the rate of 300 bbl./hr. This screw conveyor delivers cement to the boot of a cement elevator. An additional cross screw conveyor feeds cement from bulk cement trucks to the main screw conveyor. Cement elevator is a 12- x 7-in. Ley bushed centrifugal discharge type, with a capacity of 330 bbl./hr., and is driven by a 10-hp. gearmotor and roller chain drive.

This elevator, of conventional dust-tight construction, runs through an opening provided in the main bin structure, but is independent of the structure except for its support at the base. Cement flows from elevator to a Miami two-way cement valve, and then to either of two compartments of the cement bin, each compartment having a storage capacity of 400 bbl., or a total of 800 bbl. The cement storage bin is nested in the center of the main bin structure, and is carried on two 12-ft. deep plate girders which also form partitions.

Batching

Cement is fed to an automatic weigh batcher by means of two Link-Belt rotary vane feeders, operated singly or together. The cement flow to the vane feeders is assisted by low pressure pneumatic flow assisters built into the sloping corners of the cement bin.

The aggregate weigh batcher is gravity fed and operated by manual controls, equipped for the later addition of air-solenoid automatic controls. It was made by Construction Machinery Corp. Water is weighed automatically as shown in Fig. 5. The weigh batchers are installed so that the cement flows into the mixer hopper on top of the aggregate. This mixer hopper is equipped with a hydraulic gate, which enables the operator to hold one batch ready while the mixer is mixing another batch, and at the same time a third batch is weighed and held in the weigh batchers. This hopper is also equipped with a hydraulic by-pass gate, which permits rapid dry batching through a telescopic by-pass chute to mixer or dump trucks (Figs. 3 and 4).

Central Mixing

The 2-cu. yd. fast action mixer, also made by Construction Machinery Corp., discharges into a 6-cu. yd. Miami concrete hopper. This hopper accumulates the required amount of concrete for each truck. By the use of this hopper a fourth batch of concrete is actually in process, which accounts for the high production capacity of this plant. Discharge from this hopper is by means of a 30-in.



Fig. 4: Dump truck receives dry batch from telescopic chute

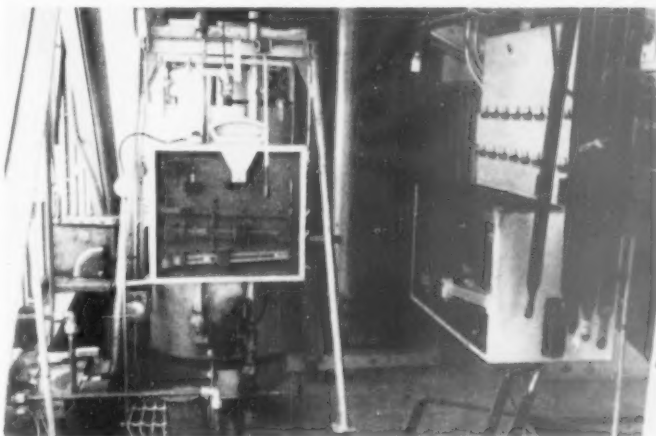


Fig. 5: Operator's station showing water weigh batcher, water tank, heat exchanger, weighing controls and hydraulic controls

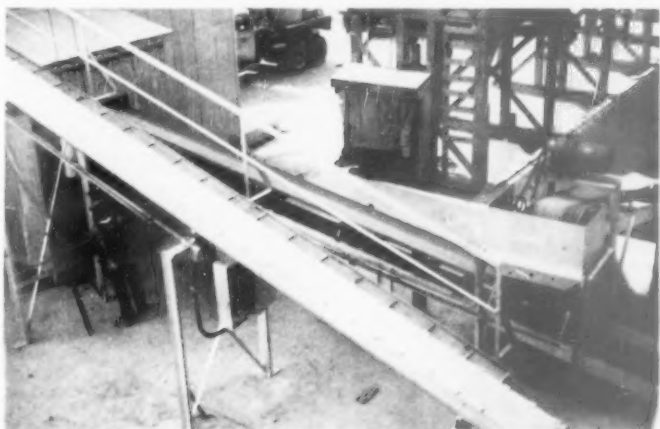
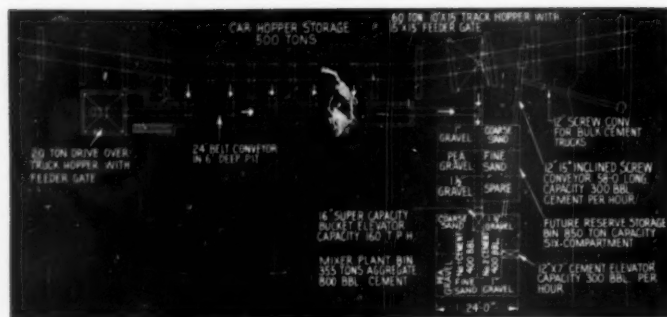
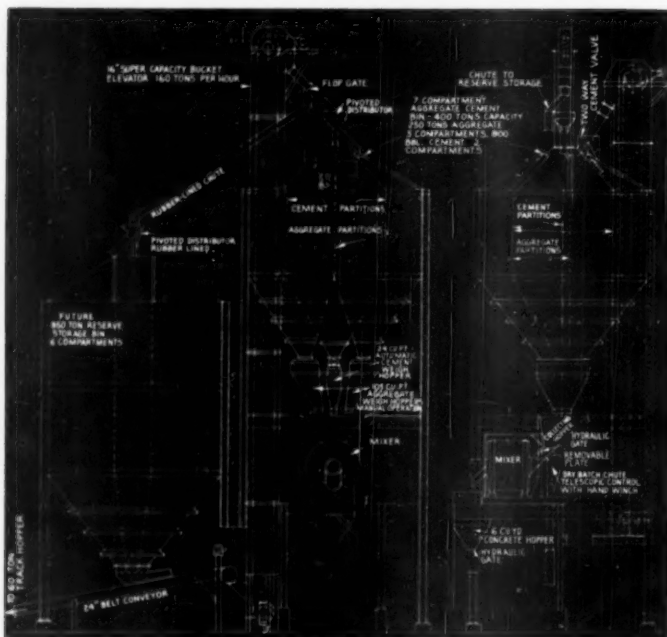


Fig. 6: View showing transfer point of belt conveyors and 12-in. cement screw from track chute to elevator



Yard plan and flow diagram of new plant



Elevation drawings of new ready-mixed concrete plant

dia. conical hydraulic valve, which was developed by Miami Fabricators after much experimentation. This valve operates under 600 p.s.i. hydraulic pressure supplied by a Vickers hydraulic pump. Its cycle is automatically controlled by means of a Vickers solenoid valve and Micro limit switches. Six cu. yd. of mixed paving concrete, about as dry as it can be made, can be discharged from this hopper in 8 sec. The same hydraulic pump also supplies power for mixer and hopper gate controls.

A gas-fired automatic steam generator, rated 25-hp. at 100 p.s.i. pressure, supplies steam for heating water and aggregate. This unit is located on the mixer floor (Fig. 3). Water is heated by means of a heat exchanger, with automatic temperature controls, and stored in a large storage tank on

the operator's floor, shown at right of water weigh batcher in Fig. 5.

Duplicate control panels for all conveying machinery are installed on the operator's floor and at ground level. Main switchboard is on operator's floor.

Design of Bins

Miami Fabricators designed the main bin structure specifically to save field erection costs. All steel, including chutes, conveyor frames, aggregate elevator casing, etc., was completely shop detailed by the designers so that any structural shop could fabricate the entire job. This method of purchasing the steel effected quite a saving for the owners.

The bin structure was fabricated in the largest sections transportable by truck or rail. In plan, the structure

is 24-ft. square. The entire bottom was fabricated in four pieces, and transported by drag to job site. Vertical side girders, each 12 ft. deep by 24 ft. long, which constitute the upper part of the bin, were bolted in place. The hopper bottoms were then raised and secured with bolted connections. All vertical and valley points were then field welded inside and outside to complete the erection. Sixty-five tons of steel in the main bin structure were erected and welded complete in 600 man hours and 60 crane hours.

The method of installing cement and aggregate elevators through the bin structure saved considerable height and length of chutes in these units, as the discharge was closer to center of the bin. While a conventional casing was used for the cement elevator, the bin partitions form the casing for the aggregate elevator through the bin. The entire top casing section for aggregate elevator above bin top was assembled completely on the ground. The head sprockets, 25-hp. gearmotor and double-roller chain drive, operator's platform, diamond-mesh grating and handrail, safety cage ladder, etc., were all installed during erection. The unit was then lifted in place and bolted to top of bin, and wind bracing installed, in 30 min. The elevator chain was hoisted in place by crane, temporary power applied to the motor, and buckets installed from bottom through the open boot section. The importance of saving erection costs is well known to every operator installing a plant, as it is usually the one unknown cost in plant construction.

The plant design incorporated an additional storage bin of 850 tons capacity, for which foundations are provided. This structure will be located between the present plant and the trestle, and will be served by chute and flop gate from main aggregate bin.

An interesting highlight in the foundation construction, one of those things which makes every contractor's life a bad dream at times, caused a few red faces among the owners and engineers. Nobody knew exactly what soil conditions would be encountered on the main footings, so they were designed and reinforced for a nominal bearing on good clay. The foundations were installed with the base of footers 4 ft. below grade, which required approximately 80 cu. yd. of concrete and 18 tons of reinforcing steel, including foundations for reserve bin. Everybody was satisfied until six weeks later when excavation for the ground level truck hopper was started. At a depth of 4 ft. 8 in. below grade was solid rock. No settlement in the main foundations is anticipated, however.

The new plant was engineered in its entirety by Miami Fabricators, Cincinnati, Ohio, a company long active in the design of sand and gravel, crushed stone, ready-mixed concrete and allied plants. In addition to the author, Roger L. Church is chief engineer of Miami Fabricators.

Brookside Building Tile Manufacturing Co., Vancouver, Wash., greatly increases capacity with new plant at site of old operation



Plant of the Brookside Building Tile Manufacturing Co.

Plant Produces Gravel And Pumice Block

BROOKSIDE Building Tile Manufacturing Co., of Vancouver, Wash., has a neat and efficient block plant in the northeast section of town. It is a good example of a profitable plant that can produce block in the 2000 to 2500 modular block per 8-hr. day range. It is also an illustration of the trend of plants in cities and towns of relatively small population to gear their production to meet the needs of the community. Vancouver, Wash., is about 10 miles north of, and just across the Columbia river from Portland, Ore. It has a population of approximately 29,500 people and serves as a trading center for adjacent urban areas. The company is owned by

F. R. Holcomb and Joe Mayes. Mr. Holcomb, who also operates a dance hall, adjacent to the plant, has been in the block business in the area for 18 years and both of his business ventures have an air of efficiency, orderliness, cleanliness and stability about them that is impressive, especially as far as block plants are concerned as many small plants are more or less of an eye-sore. A neat plant is one of the best selling agencies that the industry has.

Plant Production

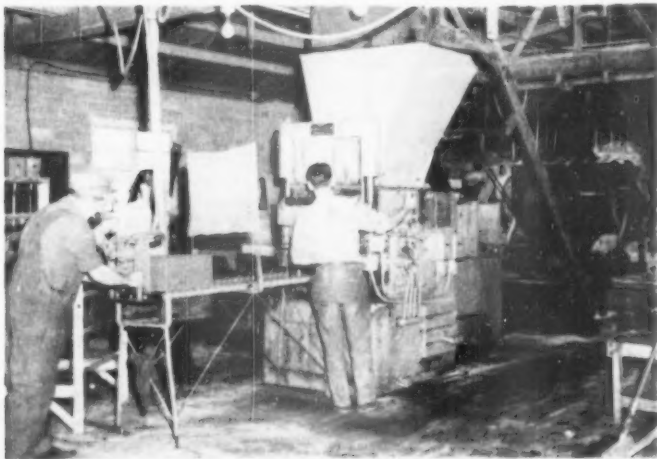
Production of the new plant, which replaces an older one at the same

site, is built around the use of one of the later model 8 "Columbia" block machines, manufactured by the Columbia Machine Works of Vancouver, Wash. This machine operates with oil hydraulic units, making the action positive. It makes a cycle in 15 sec. and produces two of the standard 8's or three of the 6- x 8- x 16-in. sizes per pallet. The machine will make any sized block up to 17½ x 16½ in., in heights of 8, 6, or 4-in. and in any conventional or special shapes. Power for the machine is supplied by two motors, a 3- and a 2-hp. unit, with controls.

Use is made of aluminum pallets that are given an oil bath and brushed before being placed in the back of the machine in the pocket designed for them. This pocket, or pallet feeder, holds a considerable number of pallets, 35 to 50, which are fed automatically into the machine, pushing the loaded pallet of block out on to a short inclined ramp or roller section about 8 in. long and wide enough to accommodate the pallet. This keeps the block out of the operator's way so that the offbearer can lift the pallet onto the steel racks. An oil-hydraulic offbearing lift unit is used. It was made by the same company that supplied the machine.

The operating cycle of this machine is as follows: feeder box moves forward and fills the form; tamp head comes down and compresses block to proper height; pallet and head drop and eject block out of the mold. As the pallet beam hits the bottom it automatically feeds a plain pallet onto the pallet holder from the rear of the machine and pushes out the loaded pallet. The block are made with controlled vibration and pressure. The

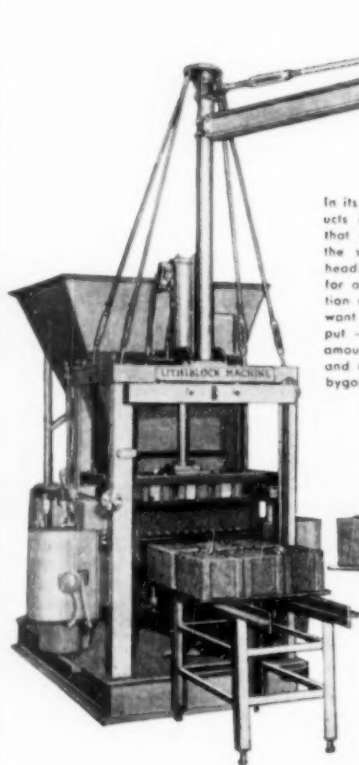
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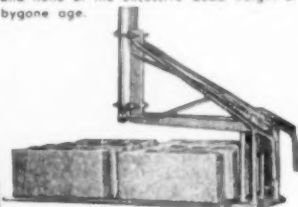
Block machine, foreground, operates hydraulically with oil pump. Skip, background, is charged by traveling mixer



IN THE CONCRETE PRODUCTS INDUSTRY *Lith-I-Block* IS THE MACHINE THAT **FITS THE AGE**



In its modernization strides, the concrete products industry has learned to its great profit that the machine which best fits the age is the surest means to lower costs, lower overhead, lower maintenance — and better prices for a better product. The Lith-I-Block production machine is expressly made for those who want the highest type of fast, streamlined output — with the fewest motions, the least amount of labor, the lowest power demand, and none of the excessive dead weight of a bygone age.



Two- and Three-Block Models

A complete cycle every 15 seconds — delivering 480 or 720 perfect 8 x 8 x 16s per hour on plain pallets — with just the push of a button. Lith-I-Block makes full use of the vibrating principle — goes all the way, without any need of applying pressure. It's the machine you'll eventually come to — so why not now!

eccentric arms are fastened to the side of the die box which is solidly mounted to the machine. This moves the mold box in an up and down motion while pressure is put on the block from the top and bottom. The machine occupies a floor space of about 5 x 10 ft. The distance from the face of the mixer to the back of the machine is about 20 ft.

Batching Equipment

The Brookside Building Tile Mfg. Co. has built its own batching equipment that features a steel bin with four compartments: two for gravel, one for sand and one for pumice. Materials are delivered to the plant by truck and a bucket elevator delivers them to the bins. Bagged cement is used. The weigh batcher dumps to a small skip that rides an overhead trolley and the operator pushes this back to the mixer and dumps it. The mixer is also mounted on small industrial rails so that it can be used to serve an older, rebuilt, Stone block machine. The low head required by the Columbia block machine easily lends itself to a skip arrangement that is very compact. The company uses the machine for both pumice and hard aggregate block. The former aggregate is very popular in the Northwest.

The racks filled with the green block are hauled to one of three steam kilns by a Hyster "40" that is operated most of the time by the partner, Joe Mayes, who also acts as plant superintendent. The three kilns are designed to hold a day's production and the curing time is from the time the kiln is filled until the following morning. Steam is supplied from a 40-hp. horizontal boiler that is provided with a Velstat automatic oil burner. Seven men operate the plant.

Booklet Reprinted

NATIONAL READY-MIXED CONCRETE ASSOCIATION has announced the publication of the second edition of "Recommended Practices for Sampling and Testing Ready-Mixed Concrete," due to the great demand for the booklet. Advantage was taken of the reprinting to make certain modifications, generally of a minor nature, and to bring references to test methods up-to-date. According to the association, even though distribution has been made, this revised edition affords opportunity for a desirable follow-up.

Builds Ready Mix Plant

H. W. GERLACH has announced construction of a ready-mixed concrete plant in Topeka, Kan., to be operated by the Gerlach Building Supply Co. The plant is to be equipped with electric-eye devices for automatic batching, a cement storage tank with a 2000-sack capacity, and storage facilities for 150 tons of sand, crushed rock and other aggregates.

Write for descriptive literature and names of nearby users.
LITH-I-BAR COMPANY
HOLLAND, MICHIGAN
Dept. CP-19

Haydite Plant

(Continued from page 163)

The steel bins over the batching equipment were supplied by the Allison Steel Co. of Phoenix, Ariz. One is a four-compartment bin with the cement division holding 525 bbl. of cement. The other bins hold 150 cu. yd. of material. The compartment holding the cement has a rectangular top section that was added to give more capacity. Boardman and Co., Oklahoma City, Okla., supplied the cement elevator and screw conveyors.

The batcher was built by the Allison Steel Co. of Phoenix, Ariz. and is a 2-cu. yd. weighing unit. It has two compartments, one for the various aggregates, and features a three-beam Fairbanks-Morse scale. Water is metered to the batcher by a Neptune water meter.

The office building of Smithwick Concrete Products, within easy access of the main highway, is 32 x 34 ft. with both exterior walls and interior partitions constructed of concrete block to stimulate much interest on the part of the public in this type of building material.

The large storage area is paved with concrete and it is evident from the orderly storage piles, the absence of debris and broken block and the neat appearance of the crew that the good housekeeping methods practiced at the Smithwick plant in Portland also prevail at the Eugene plant.

Personnel

S. Carl Smithwick, president of Smithwick Concrete Products, was formerly district engineer for the Portland Cement Association with regional headquarters in Spokane, Wash. Carleton G. Smithwick is vice-president and secretary-treasurer of the company. Vice-President Otto C. Frei is in charge of the Haydite plant at Portland and Paul P. Klemens, vice-president, is production manager of the Portland block plant. Lane W. Wilcox is manager of the Eugene, Oregon, operation and is also a vice-president of the parent company. Ed DeKester is sales manager at the Eugene operation and Paul L. Nutt director of sales of the two enterprises in Portland. Maxine Lipscomb is secretary to Mr. Smithwick. Jim Marsh is the bookkeeper.

The Eugene staff consists of Mrs. Lane W. Wilcox, secretary; Mike Fitzgerald, plant foreman; Bill Wittliff, bookkeeper; Dwight DeHaven and Gordon Perluch, sales.

Revise Membership List

AMERICAN CONCRETE PIPE ASSOCIATION, Chicago, Ill., is revising its 1949 membership list to include names of new members, changes in personnel of member companies and changes in association officers. The information is being obtained from form letters sent to members of the association.



IN THE BUILDING FIELD

The CONCRETE MASONRY UNIT THAT BEST FITS THE TIMES

After all, the only reason you have a block machine is to be in the business of making blocks that sell. If you want a building block that has more than a cellar future, more than a cheap market — then investigate Lith-I-Block! Lith-I-Block producers do not operate to a limited demand or a restricted market — they have the concrete masonry unit that best fits the times — one that is ideally made with the quality running true all the way thru — the kind of accuracy and uniformity and precision that gets it above the ground into the superstructures where the big volume is to be obtained — and where prestige is made for the Lith-I-Block producer. Why not ride the Lith-I-Block tide — it means more business coming your way! You'll get better quality blocks — and more to each sack of cement! Write for the convincing proof on Lith-I-Block superiority — and get it now while the getting is good.

LITH-I-BAR COMPANY

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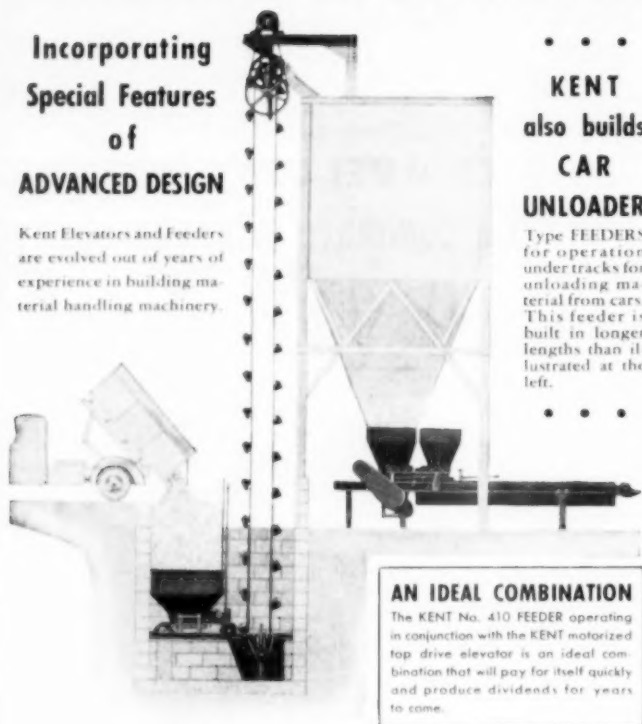


All Shapes and Sizes to Fit All Purposes
Adaptable to All Aggregates

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Incorporating Special Features of ADVANCED DESIGN

Kent Elevators and Feeders are evolved out of years of experience in building material handling machinery.



KENT also builds CAR UNLOADER

Type FEEDERS for operation under tracks for unloading material from cars. This feeder is built in longer lengths than illustrated at the left.

AN IDEAL COMBINATION

The KENT No. 410 FEEDER operating in conjunction with the KENT motorized top drive elevator is an ideal combination that will pay for itself quickly and produce dividends for years to come.

No. 410 ADVANCED MODEL FEEDER

For handling sand, crushed stone, aggregate, etc. from hopper or Gondola Car.

It is driven steadily and smoothly by the elevator motor through the elevator belt. Material is continuously fed into boot by long-life rubber belt — pressure, grease lubricated anti-friction bearings — rollers support belt at intervals.

Adjustable hopper gate governs volume of material fed into elevator boot.

No. 139 KENT MOTORIZED ELEVATOR

Constructed entirely of high grade approved materials. All metal except belts.

Unit drive is by electric motor through V-belts. Shafts revolve on anti-friction pillow blocks, pressure grease lubricated.

Elevator is easily attached to bin by means of heavy channels at right angles to main members.

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Pumice Research

WASHINGTON STATE INSTITUTE OF TECHNOLOGY, Division of Industrial Research, Pullman, is currently engaged in a research program on pumice concrete. The research was requested by concrete products manufacturers and is being carried out in cooperation with them.

At the present time the institute is concentrating on the causes and control of shrinkage in walls constructed with pumice concrete block. Although no final results are yet available, preliminary work indicates that excessive shrinkage of the block after being laid in a wall can be minimized by using a properly cured block containing (a) a minimum of moisture and (b), the inclusion of steel reinforcing in the wall.

An investigation of the weathering abilities of various paints for use on exteriors of pumice concrete masonry also is being carried out. Paints are applied to walls of about 10-sq. ft. area, and tested at an accelerated rate in a specially-constructed weathering cabinet. All types of suitable coatings are being checked, particularly transparent types.

The problem of correct mix ratios for pumice concretes also is being investigated by the institute, and a large number of test cylinders are being prepared and strength-tested. Tests on Oregon pumice are included in the present program since the bulk of pumice used by Washington block manufacturers originates in Oregon where large, easily accessible deposits of excellent material are available.

Freezing and Thawing Tests of Concrete

RESULTS OF THE STUDIES of resistance to freezing and thawing of concrete have been published by the National Sand and Gravel Association. These tests, made in the association's Research Laboratory at the University of Maryland, are the first completed in the new automatic machine which subjects concrete specimens to eight cycles per day of freezing at 0 deg. F. in air and thawing at 40 deg. F. in water. The report states that the machine does an excellent job of evaluating the relative durability of various types of concrete materials and has the advantage over the old manually-operated equipment in requiring only about one-eighth the time previously necessary.

Prestressed Concrete

JOHN A. ROERLING'S SONS Co., Trenton, N. J., has printed a booklet, prepared by engineers of the company, on the subject "Prestressed Concrete." The company plans to extend its service to other firms in helping to solve specific problems regarding the development of new application techniques for prestressed concrete.

Hotfoot for a Hopper



GIVE that stubborn material a 'hotfoot' with a Cleveland Type LSRR Air Vibrator and get it moving on the double. Simply slide the vibrator into the bracket that is standard equipment on most covered hopper cars, and whether it's cement, or lumpy or powdered chemicals, it will move freely and continuously.

Air-operated, the Cleveland Type LSRR Vibrator is low in air consumption as well as cost, and requires minimum maintenance. Made of steel for rugged service, mounting brackets are wedge-type, fitting easily

into the female bracket attached to the car. Female brackets are also obtainable from us for any application where only periodic vibration is required.

Instant starting, with full power is assured.

A catalog illustrating the diversified use of Cleveland Air Vibrators and accessories, on bins, chutes, hoppers, screens, storage tanks, etc., is available by just filling in the coupon, or for more information on your particular problem, just indicate the kind of material you've been 'stuck' with.

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HELPS GAIN NEW CUSTOMERS!

A. E. Fowler & Sons, ready mixed concrete operators, Orange, California, had this to say about their fleet of nine, 3-yard Challenge Mixers. "We find that our contractor customers appreciate the ease in which we get between and around forms without damage to sidewalks, driveways, etc.; also, our ability to get rid of the 3 yard load without the necessity of standby time."

Challenge is by far your BEST MIXER BUY!

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EXCLUSIVE NATIONAL
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the modern, streamlined truck mixers

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Precast Bridges

UNIVERSAL CONCRETE PIPE CO., Columbus, Ohio, has made a development in small bridge construction which it calls a "Package Bridge." In new construction, the process combines precast concrete cribbing, deck slabs and bridge seats. Three men and a crane can, according to the company, install a bridge of this type on the average secondary road in two days. The company estimates that its new development cuts costs of bridge construction and repair by as much as 30 percent and practically eliminates "detour time." In bridge reconstruction, the slabs are trucked from the plant to the job and bolted to the foundation after the old deck is ripped out.

Universal precast bridge slabs weigh approximately 300 lb. per lineal ft. or three tons for a 20-ft. section.



View of new "packaged" bridge

The aggregates used are limestone, river sand and air-entraining cement, which make it unnecessary to use bituminous material on the surface. The mixture is placed in casting forms that contain steel reinforcing rigidly secured in wire mesh. The concrete is vibrated to insure perfect bond with the steel and then cured for seven days.

Each bridge deck slab has lifting holes placed at the center of gravity for easy handling. The average installation time from truck to bridge seat is 15 minutes, according to the company.

Use of the slabs for bridge construction is approved by the Bureau of Public Roads at Washington. The slabs are designed for H-20-5-16 or H-15-S-12 loading of standard specifications

THE Quinn Standard FOR CONCRETE PIPE

The Quinn Standard is known as the best the world over, wherever concrete pipe is produced and used. Backed by over 35 years' service in the hands of hundreds of Quinn-educated contractors, municipal departments and pipe manufacturers who know from experience that Quinn pipe forms and Quinn mixing formulas combine to produce the finest concrete pipe at lowest cost.

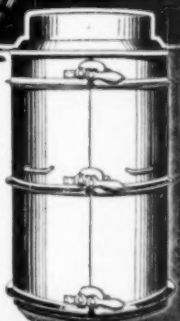
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For making pipe by hand methods by either the wet or semi-dry processes. Built to give more years of service—sizes for pipe from 10" up to 120" and longer—longer and groove or bell and pipe at lowest cost.

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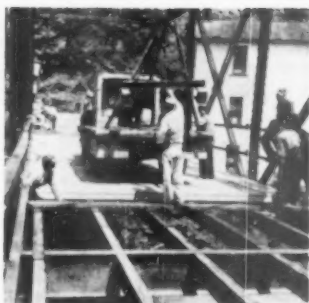
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AMERICA'S FINEST MOLDS AND LOWERING DEVICES



TERMINOLOGY FRANCHISES
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EQUIPMENT DIVISION
1820 LUCAS HWY. ST. LOUIS 20, MO.



Laying deck slabs for concrete bridge

for highway bridges of the American Association of State Highway Officials.

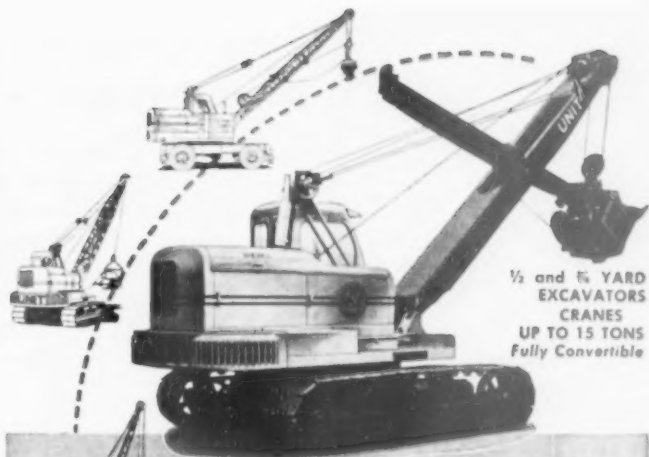
Universal precast concrete cribbing is supplied in two types—open face and closed face. The latter is used where there is a possibility of the finer backfill materials washing out. Unlike gravity or monolithic concrete abutments, the cribbing normally does not require concrete footers or piling. In addition, it may be salvaged 100 percent in case of relocation.

Cement Shortage Cuts Block Output

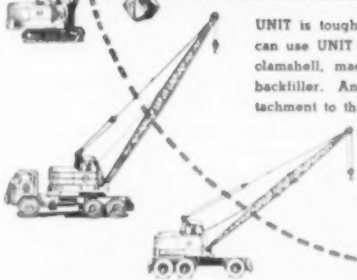
ANCHOR CONCRETE PRODUCTS INC., Cheektowaga, N. Y., has cut its production 50 percent due to the cement shortage. The plant normally turns out about 30,000 block per day, but this is being cut to around 15,000. Frederick W. Reinhold, president of the firm, said the plant's present inventory of block stored in the yard for curing is sold out and that the company has a 10-week order backlog on hand.

Distributes Wall Facing

PERMA-STONE ETX CO., Longview, Texas, has been appointed exclusive distributor in East Texas for the outside wall facing, called "Perma-Stone." This is stone-like veneer having the color, texture and appearance of natural stone. It is molded and cast directly on walls and can be applied to any type of building.



UNIT BUILT FOR ALL-AROUND Heavy-Duty Service



UNIT is tough! UNIT is versatile! That's why you can use UNIT on any type of job requiring shovel, clamshell, magnet, dragline, trencher, grapple or backfiller. And it's easy to change from one attachment to the other, right on the job. UNIT gives

you all the power and speed you need, plus these exclusive features: Automatic traction brakes . . . Disc-type clutches . . . Drop forged alloy steel gears . . . Splined shafts . . . One-piece cast gear case . . . Straight-line engine mounting. Mobile and Crawler Models Available

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GREATER
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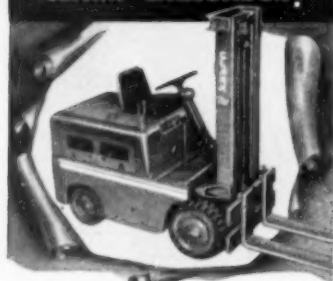
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FASTER! from forward to reverse
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BETTER! neutral tests prove
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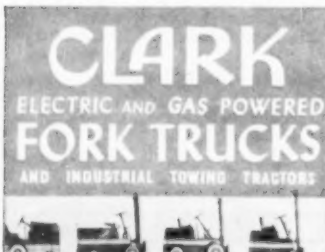
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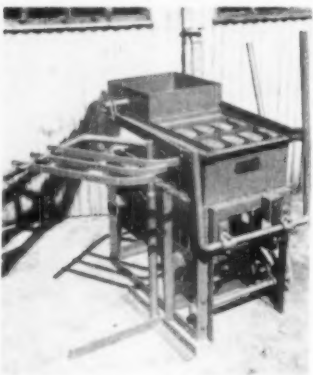
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NEW MACHINERY

Lightweight Block Machine

GENERAL ENGINES Co., INC., Gloucester City, N. J., has developed a lightweight, power-driven machine for the production of concrete and cinder block, known as the Twin-Block machine. The capacity of the equipment



Small, compact block machine

is 1500 units per day, the manufacturer claims. It weighs 600 lb. and is of welded steel construction. It combines electric vibrating, compacting and traveling.

The machine produces two 8- x 8- x 16-in. block or its equivalent in one operation. Floor space required is 30 x 42 in.

Mobile Trolley Batcher

C. S. JOHNSON Co., Champaign, Ill., has brought out a new model of its Lo-Bin trolley batcher to which a pneumatic-tired wheel and two-bar assembly have been added. The resulting improved portability reduces time losses between job moves and elimi-



Portable trolley batcher on pneumatic tires

nates the need for dismantling the batcher when changing job locations, the manufacturer claims.

The Lo-Bin trolley batcher is used as a flexible aggregate batcher. It is designed with a maximum bin capacity of 30 tons and with a low charging height of only 9½ ft. With flared extension panels removed, the bin



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23

CEMENT & MORTAR COLORS!

Only Williams can offer you this broad selection of fine Cement and Mortar Colors. With a choice of 23 shades, you can quickly and easily get a color having chemical and physical properties which hit your color specifications "on the head".

IN CEMENT COLORS WILLIAMS

offers you a choice of 18 shades--6 Reds, 3 Greens, 3 Browns, 3 Yellows, 1 Black, 1 Blue and 1 Orange. Each shade is manufactured to meet the most exacting specifications for cement work as recommended by the American Concrete Institute and the Portland Cement Association.

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offers you a choice of 5 different shades—one shade in double strength red, light buff, dark buff, chocolate and black. Each of these colors may be used with excellent results with any standard mortar mix or with a ready-made Brick-layer's Cement.

Write today for color samples and complete technical information on how cement and mortar colors may be used for improved results. Address Department 10, C. K. Williams & Co., Easton, Pennsylvania.



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COLORS & PIGMENTS

C. K. WILLIAMS & CO.

East St. Louis, Ill. • Easton Pa. • Emeryville, Cal.

measures 7½ ft. in height and holds eight tons.

Trolley batchers are made to handle two, three or four aggregates. The 22-cu. ft. traveling aggregate hopper is cantilevered to ride out beyond the end of the track.

Curing Unit for Concrete Block

LITH-I-BAR Co., Holland, Mich., has introduced the L-I-B Hydrator for providing automatically controlled forced vapor heat curing of concrete masonry units. The company states that the unit is literally a rain maker which sets up a humid atmosphere within the kiln so saturated with moisture that it is constantly dripping dew. This heavy, water-soaked air is in forced circulation, with precipitation occurring uniformly throughout the kiln, according to the manufacturer.

In operation of the unit, after the kiln is filled, a remote control panel takes over. It automatically starts the gun-type oil burner and stops it when the curing cycle is completed. It automatically controls the forced air circulation and turns the water spray nozzles on and off. The curing cycle may be set for whatever heat and moisture conditions are needed for ideal curing, the manufacturer states.

Heavy-Duty Lift Truck

BAKER INDUSTRIAL TRUCK DIV., Baker-Raulang Co., Cleveland, Ohio, has introduced the Type FT central-control fork truck to meet needs in the 3000 to 4000 lb. capacity class. Specifications as disclosed by the manufacturer are as follows: for the 3000



Industrial lift truck in 3000 to 4000 lb. capacity class

lb. capacity unit, width over drive wheels, 35½ in.; outside turning radius, 73 in.; single lift, 64 in.; telescoping lift, 126 in.; wheelbase, 43 in. For the 4000 lb. capacity unit: width over drive wheels, 37½ in.; outside turning radius, 73 in.; single lift, 64 in.; telescoping lift, 126 in.; wheelbase, 43 in.

A unit welded, heavy-gauge all-steel frame contains an integral hydraulic tank. A steel plate bumper at the rear of the truck provides effective counterweight and is welded to the frame, according to the company.

Jaeger-engineered for BIGGER PAYLOADS

LIGHTER—by 600 to 1600 lbs.

FASTER—in every function

LOWER COST—to buy, maintain

Engineered, not stripped, for lighter weight. No change in heavy gauge of drums and blades. Many advanced features. Send for Bulletin TMH-10.

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603 Dublin Avenue,
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2, 3, 4½, 5½ cu. yd. sizes.
End-loading or sealed drum
top-loading types.

Fluid drive, if you want it.

"Low Charge" truck mixers in
sizes up to 10 cu. yds.

**It's Economical...It's Practical...
It's Built for the Job!**



Baughman BULK CEMENT TRANSPORT

Self Unloading . . .

Designed specifically for cement transport. Low in cost because of modern engineering and production methods. Built of high tensile alloy steel for more strength with less weight, giving **MORE PAYLOAD**. Waterproof manholes spaced for capacity loading. Catwalk top . . . climbing ladder. Electro welded throughout. Available in 15' to 33' lengths.

Twin screws give fast action . . . covered with special air cells for easy starting and high speed discharge. Equipped with powerful motor . . . all controls conveniently located on outside of body. Simple . . . positive . . . immediate.

Write for full details on the Baughman Line of transport bodies and conveyors.



BAUGHMAN MANUFACTURING CO., Inc.

610 Shipman Road

Jerseyville, Illinois

"There is a Baughman Distributor Near You"

"BRANFORD" Vibrators

**Branford's Pneumatic Big 3 Offer
Step-by-Step Savings For Con-
crete Products Plants**



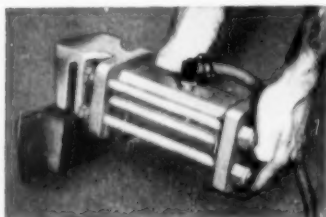
"BRANFORD" Car Shakeout Vibrator

Low cost portable shakeout that effectively unloads cement and other bulk materials from Covered Hopper-bottom Railroad Cars.



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Eliminate destructive piling and sludging, assures instant flow from storage bins and feeder hoppers.



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Produces smoother—denser finished products. Quickly and easily moved about as required. Ideal for concrete pipe, burial vault, septic tank, or building forms.

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Vibrator Company

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NEW HAVEN, CONN.



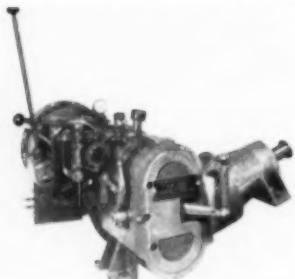
Lift trucks equipped with special fork

Lift Truck Fork

SCHMIDGALL MANUFACTURING CO., Peoria, Ill., has introduced the Schmidgall No. 333 block fork. Prongs of the fork are spaced to handle two 16-in. stretcher courses to facilitate truck unloading, the company states, and to provide more stable support for higher yard stacking. Increased clearance for the prongs is said to allow lift truck operators to pick up block cubes faster. The No. 333 is designed to fit any lift truck. Its operation is reported to be completely automatic, with no pallets required and no controls between the truck and the fork. The stretcher course is held in place by grippers which are forced against the block by the weight of the load. The 16-in. width of stretcher courses may be formed by four 4-in. block, two 8-in. block or one block turned on the 16-in. width, the company says: The company also produces a No. 322 which handles 48- x 23-in. cubes and a No. 235 for 48- x 40-in. cubes.

Torque Converter Mixer Transmission

TRANSMISSION AND GEAR CO., Dearborn, Mich., has introduced a torque converter and fluid flywheel for use as



Transmission for truck mixers is the torque converter type

a truck mixer transmission. Advantages claimed by the manufacturer are that the new unit provides a 50 percent reduction in required horse-

power, there is total absence of shock loads, and clutch life is greatly increased. The torque converter transmission will reduce the engine requirement from 55 to 28 hp, the manufacturer also claims. This is practicable since the converter transmission has a 3 to 1 power multiplying factor.

Concrete Cutter

FELKER MANUFACTURING CO., Torrance, Calif., has introduced the Di-Met standard model concrete cutter, a lighter weight unit than other models in the company's line. The standard model uses a 12 in. maximum dia-



Lightweight model concrete cutting machine

mond wheel size on either the right or left end of the spindle, cutting to a depth of 3½ in. The diamond wheel can be lowered or raised by means of a manually operated worm and gear.

Two coolant provisions have been made, the company states. A 15-gal. tank supplies water to the blade when other sources are unavailable. Pressurized water may be supplied from mains or tank trucks through a hose to an independent water connection. Valves are provided which shut off the 15-gal. tank supply when water is furnished through a hose. Jets force the

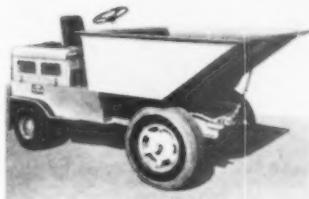
water stream against the blade sides.

The standard model is powered with a 7½-hp. Wisconsin air-cooled gasoline engine which is easily removed, according to the manufacturer.

Small Haulage Vehicle

CLARK EQUIPMENT Co., Battle Creek, Mich., has redesigned its Tractor line of haulage vehicles. Three new features the company lists are increased speed, reduced size and greater stability.

A new 2-speed transmission has been added, permitting 14 m.p.h.



Redesigned haulage vehicle with short turning radius

travel in high gear and 8 m.p.h. in low gear, according to the manufacturer. The wheelbase reduction gives a one foot decrease in turning radius. The units are supplied in two models, "Tip" and "Dump," each with a bulk-load capacity of up to 40 cu. ft., and weight carrying capacity of 4000 lb.

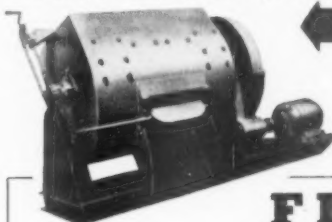
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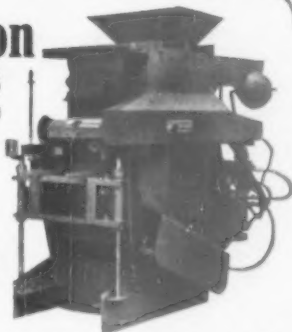
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Seattle Concrete Pipe Co. uses its 9-ton Gerlinger Lift Truck to hustle 72-in. reinforced concrete pipe around its plant. 5-ton pipe, plus form and pallet, often means an 8-ton load for the Gerlinger to lift and move—sometimes in rough and muddy going. The Gerlinger takes such heavy lifts in stride without teetering or digging in. The balanced weight distribution of the Gerlinger keeps 54% of the weight where it's needed for greatest traction and braking—over the front wheels—even when unloaded.

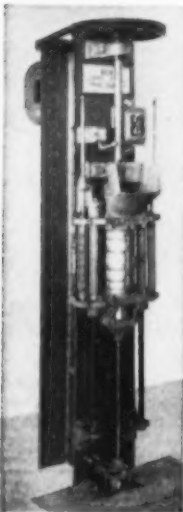
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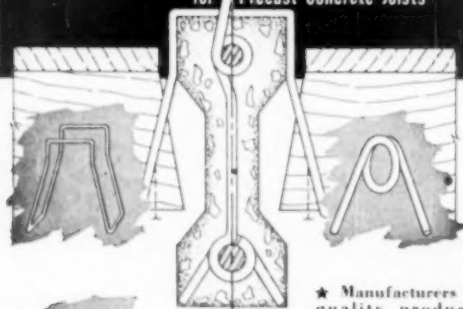
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New High Speed Low Cost
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THE MULTIPLEX MACHINERY CORP.
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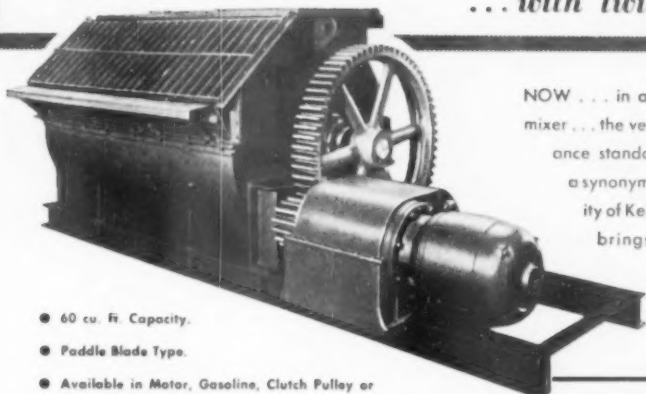
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NOW ... in a new, big-production, big capacity mixer ... the very same high precision and performance standards that have made Kelley mixers a synonym for perfection. With twice the capacity of Kelley's famed "30-D" Mixer, the "60-S" brings you greater efficiency, greater economy, more sustained, faster production. Yet, the over-all height is the same as the "30-D".

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The Platform Truck
"Custom-Built" for your
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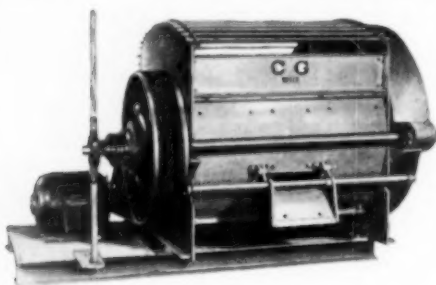
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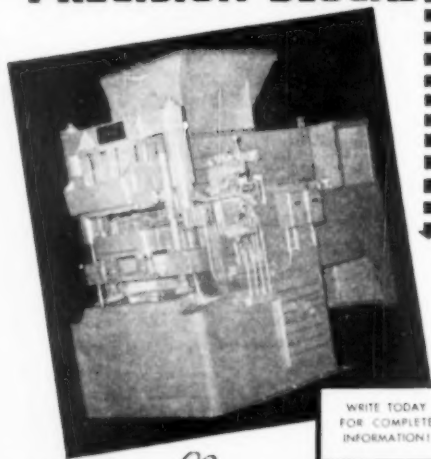
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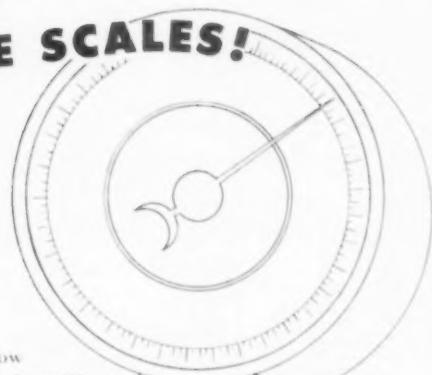
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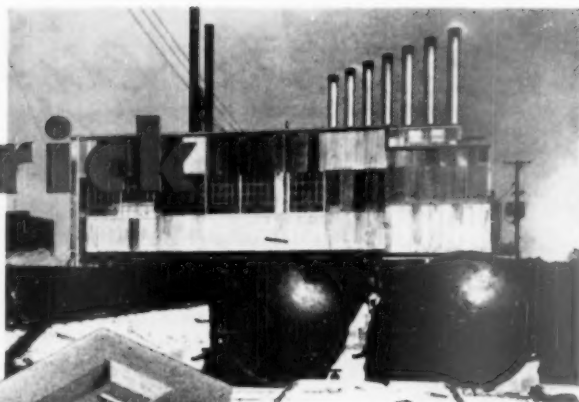
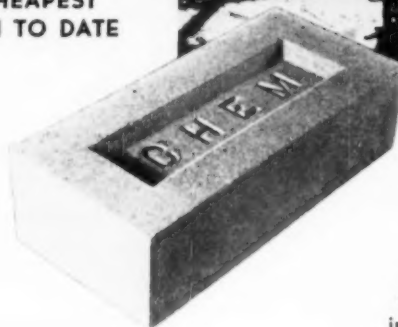
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MADE WITH THE CHEAPEST
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"CHEM BRICK" re-
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is made only with
sand and waste mate-
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Detroit Brick & Block Company, first licensee by
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"CHEM BRICK"

"CHEM BRICK" . . .

the sensational, new building mate-
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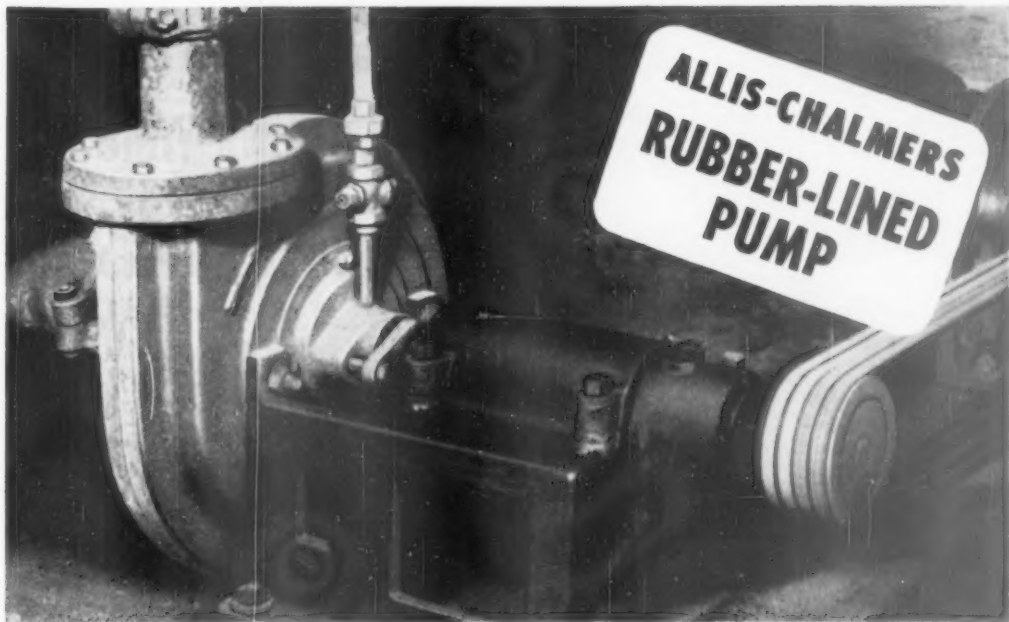
Boxed at left are excerpts from test reports on "CHEM BRICK" made by Pittsburgh Testing Laboratory. Note distinctive appearance of home pictured utilizing "CHEM BRICK" as facing material.

PITTSBURGH TESTING LABORATORY
1000 PENN. ST.
PITTSBURGH, PA.

REPORT
TESTS OF "CHEM" BRICK
MANUFACTURED BY
DETROIT BRICK & BLOCK CO.

(April 22, 1949)

COMPRESSION
(8 Specimens Standard Flatbed)
No. 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 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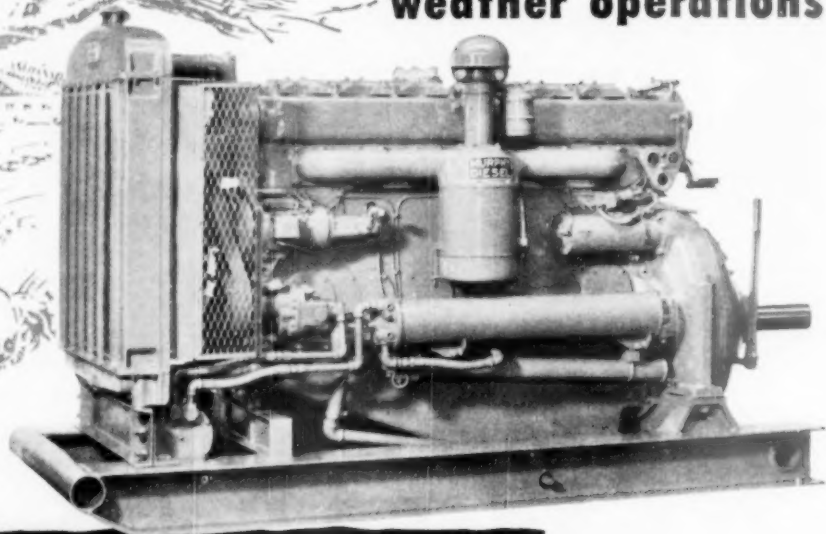
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Automotive Shovel With Hydraulic Crowd and Hoist Speeds Up Excavation Work

**Unit Reduces
Excavation Costs;
Loads Up To One
Cubic Yard A Minute**

MOVING SHOVEL LOADERS to and from jobs is one of the most expensive unproductive costs in excavation work. Contractors lose hundreds of hours and spend thousands of dollars annually moving this equipment. Developments since the war show that contractors can be relieved greatly of these costs. One of the most successful developments has been the manufacture of the rubber-tired Dempster-Diggster shovel loader that travels at truck speeds.

Digs Through 15 Foot Bank

Construction men have found that on big jobs the Dempster-Diggster has no equal for working in tight places and for freeing big shovels for heavier work. The Diggster has an 8 foot 10 inch crowding reach, will dig through a 15 foot bank, and will dig 15 inches below grade.

Manufacturer's tests and contractor's reports show that the Diggster will load up to one cubic yard a minute. This speed in excavation is accounted for, mainly, by the Diggster's exclusive independent hydraulic crowd and hoist action, the hydraulic steering, and wheel-type traction.

The power crowd permits bucket to keep digging until loaded . . . no digging with wheels. The hydraulic steering gives the driver sensitive, finger-tip control. When accelerated, a one-handed twist of the steering wheel puts the machine in any desired position. By operating on rubber-tired wheels, the



ENCLOSED STEEL CAB protects operator against inclement weather.



THE DEMPSTER-DIGGER is shown here digging out a 15 foot bank of hard chert. The power crowd permits bucket to keep digging until loaded . . . no digging with wheels.

Diggster, of course, can move at the fastest possible speed.

Not A Fair Weather Machine Only

Under adverse conditions on a state highway near Charleston, W. Va., recently, the Diggster loaded 150 cubic yards of sticky blue clay in only three hours. The work consisted of cleaning up slides on 14 foot embankments on both sides of a concrete road. The weather was not cooperative, inasmuch as considerable rain fell the night before. But the Diggster showed no tendency to slide. The job foreman stated that it loaded more material in two hours than the $\frac{3}{4}$ and $\frac{1}{2}$ cubic yard truck shovels normally did in an entire day. This and many other operations in inclement weather have proved that the Diggster is not a fair weather machine only.

The Dempster-Diggster has a 15 foot turning radius, is 20 feet long when bucket is in traveling position, and is nine feet and six inches in height.

Four standard interchangeable buckets of two types are available. Digging buckets with four bottom teeth in 1 and $1\frac{1}{4}$ cubic yard (heaped) capacities. Materials handling buckets in $1\frac{1}{2}$ and 2 cubic yard (struck) capacities.

Crawler Traction Available

For fast, efficient operation in difficult terrain, the Diggster is available with crawler-type traction.



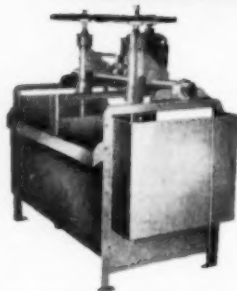
Complete information and prices may be obtained by writing the manufacturer, Dempster Brothers, Inc., Knoxville, Tenn.



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MANY
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Agitair Flotation machines represent the utmost in design flexibility. The Agitair, by simple changes in impeller characteristics, functions efficiently as a rougher, cleaner, or scavenger in both metallic and non-metallic flotation circuits; also handles various degrees of grinding and specific gravities.

Let competent, trained Galigher engineers solve your flotation problems. Agitair Flotation machines, designed and constructed by Galigher, are furnished in standard welded steel construction, with natural rubber covered parts.

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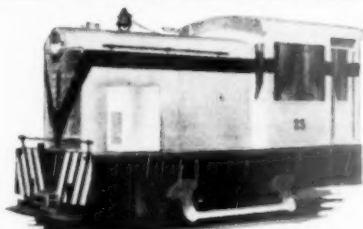
- Solidly welded; water and dust-tight.
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- Hubs keyseated in line, with two set screws.
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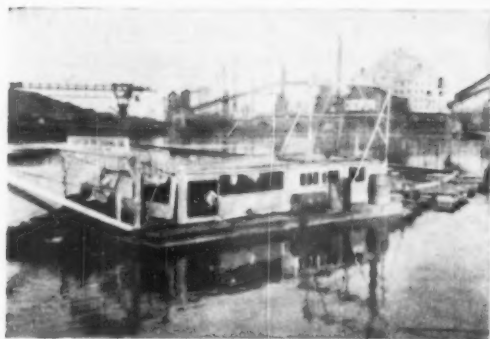
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...with an 8" H & B Dreadnaught Pump

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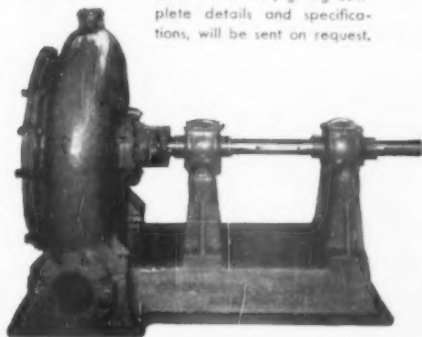
This is a typical example of the operating dependability and economy of H & B dredging pumps. H & B dreadnaught type pumps, designed especially for heavy duty jobs with stringent head conditions, are available in 6", 8", 10", 12" and 15" sizes. H & B standard type pumps, in 4", 6" and 8" sizes, are recommended for use under ordinary working conditions and moderate heads.

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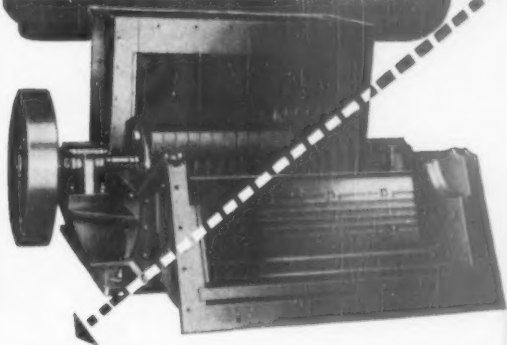


**HETHERINGTON & BERNER
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Bulletin DP-147, giving complete details and specifications, will be sent on request.



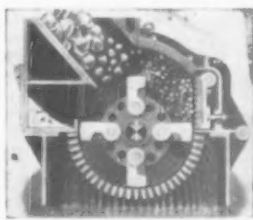
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Sectional view of Williams' "Heavy-Duty" hammermill, with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.



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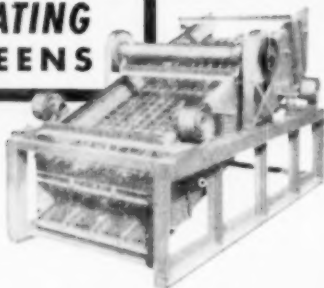
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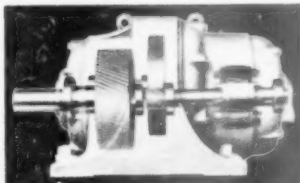
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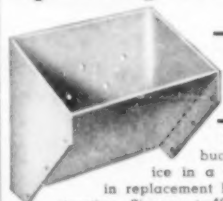
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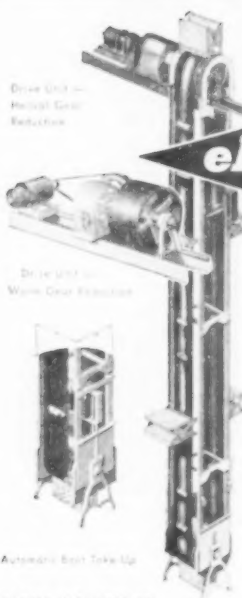
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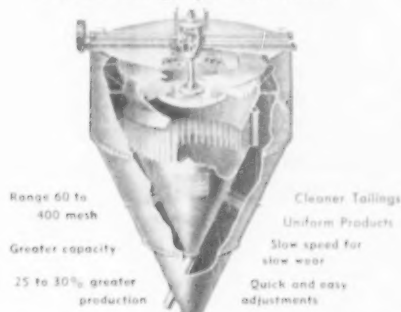
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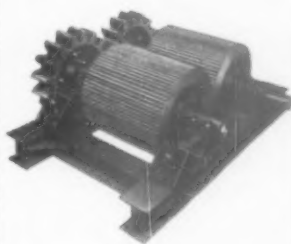
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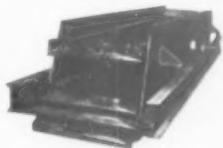
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JAW TYPE: 24x36, 24x48, 24x60, 24x72, 24x84, 24x96, 24x108, 24x120, 24x132, 24x144, 24x156, 24x168, 24x180, 24x192, 24x204, 24x216, 24x228, 24x240, 24x252, 24x264, 24x276, 24x288, 24x300, 24x312, 24x324, 24x336, 24x348, 24x360, 24x372, 24x384, 24x396, 24x408, 24x420, 24x432, 24x444, 24x456, 24x468, 24x480, 24x492, 24x504, 24x516, 24x528, 24x540, 24x552, 24x564, 24x576, 24x588, 24x600, 24x612, 24x624, 24x636, 24x648, 24x660, 24x672, 24x684, 24x696, 24x708, 24x720, 24x732, 24x744, 24x756, 24x768, 24x780, 24x792, 24x804, 24x816, 24x828, 24x840, 24x852, 24x864, 24x876, 24x888, 24x900, 24x912, 24x924, 24x936, 24x948, 24x960, 24x972, 24x984, 24x996, 24x1008, 24x1020, 24x1032, 24x1044, 24x1056, 24x1068, 24x1080, 24x1092, 24x1104, 24x1116, 24x1128, 24x1140, 24x1152, 24x1164, 24x1176, 24x1188, 24x1200, 24x1212, 24x1224, 24x1236, 24x1248, 24x1260, 24x1272, 24x1284, 24x1296, 24x1308, 24x1320, 24x1332, 24x1344, 24x1356, 24x1368, 24x1380, 24x1392, 24x1404, 24x1416, 24x1428, 24x1440, 24x1452, 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FOR SALE

SHOVELS-CRANES-DAGLINES

Knottling 605 Diesel crane 1 1/2 yd. Boom 30'.
Lima 604 Diesel crane 1 1/2 yd. New 1948.
Lorain 80 Diesel shovel 1 1/2 yd. Excavator.
Lima 1201 2 1/2 yd. Diesel Shovel.
Northwest 607 2 1/2 yd. Diesel Shovel.
Northwest Model 35 1/2 yd. Diesel shovel.
Marion Model 37 1 1/2 yd. Elm. Shovel.
P&H 855B 2 yd. Diesel Shovel. Excavator.
Northwest Model 6 2 yd. Diesel crane.

CRUSHERS

JAW: Ames 18x20, 18x25, 18x30, 18x37, 18x42, 18x52, 18x62.
18x72.
Cedar Rapids 20x30, 20x40.
Farvel 18x30, 18x40, 18x50, 18x60, 18x70, 18x80.
Buchanan 30x42, Type C 40x48.
Good Roads Baltimore 15x30.
Traylor 18x30, 24x30, 30x42.
Allis Chalmers 30x48.
Good Roads 18x30.
Tolomith 18x32.

Champion 18x30, 18x40, 18x50, 18x60, 18x70, 18x80.

GYRATORY: Allis Chalmers McCully, 6" 7 1/2", 8", 9", 12R, 20", 30".

14" Northwest 24" 36" Gyratory, 18" 24" Intermittent Tolomith, Simon 4' short H.I. Caster.

Tolomith 5H, 10-B, 12-B, 14-B.

Kennedy Van 24x7, 18, 24x8, 8, 27.

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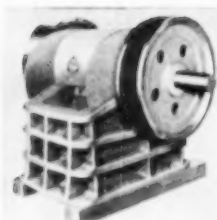
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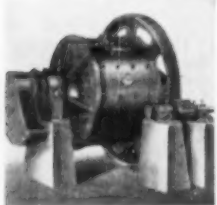
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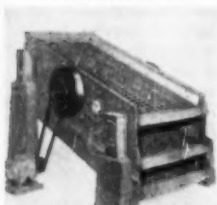
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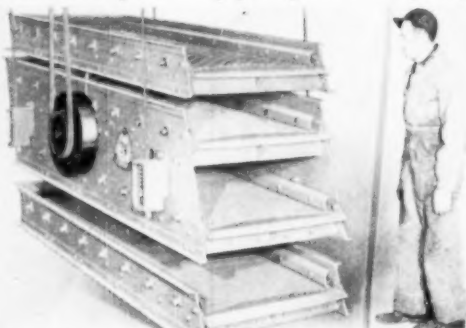


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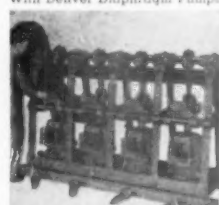
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